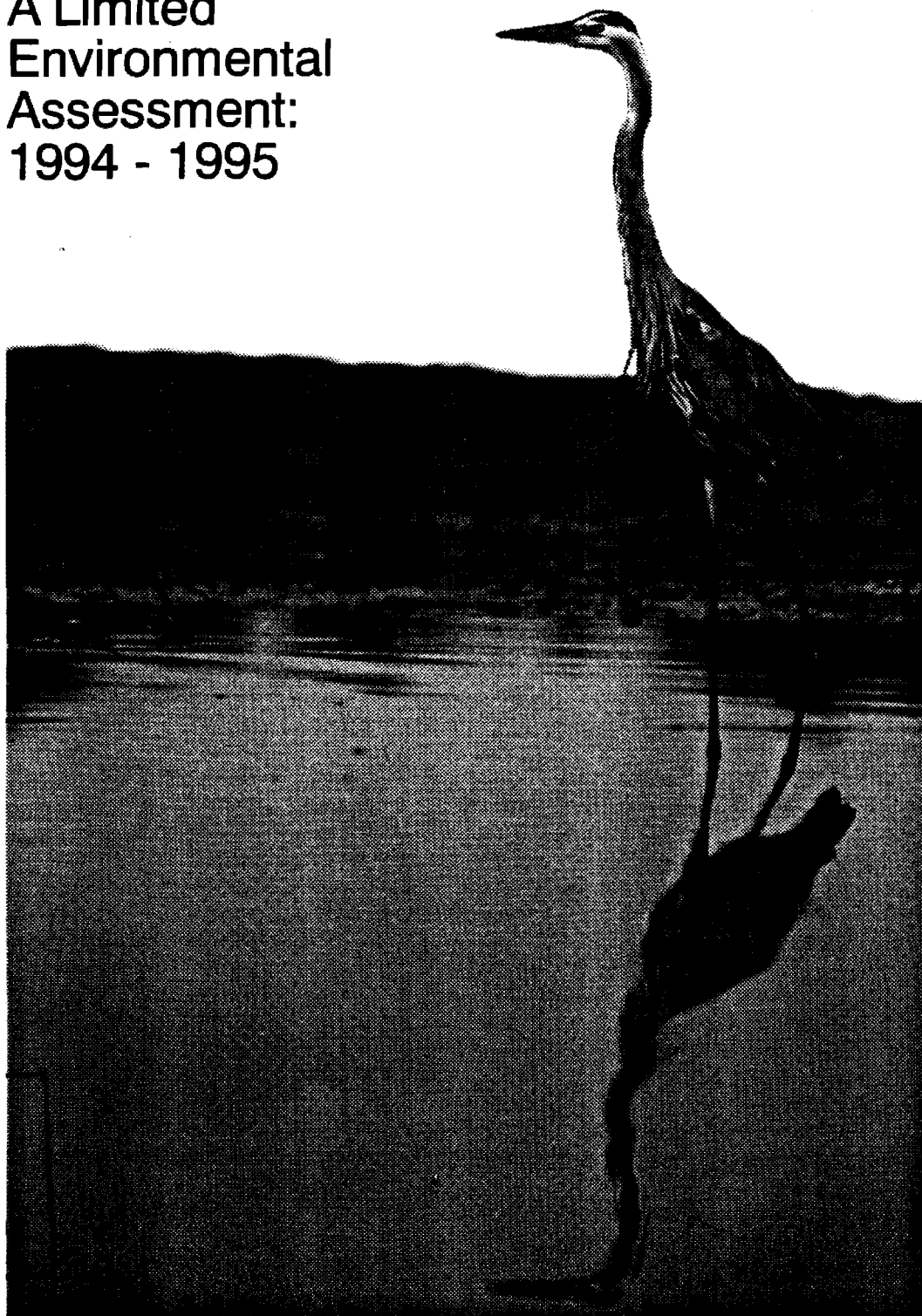




The Shoalwater Bay Reservation

A Limited
Environmental
Assessment:
1994 - 1995





United States Environmental Protection Agency
Region 10, 1200 Sixth Avenue, Seattle, WA 98101-1128

**The Shoalwater Bay Reservation:
A Limited Environmental Assessment
1994 - 1995**

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Prepared By

U.S. Environmental Protection Agency (EPA)
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Region 10

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EXECUTIVE SUMMARY

In July, 1992, EPA learned of an alarming statistic concerning the Shoalwater Bay Indian Tribe of Western Washington: Over 90 per cent of Tribal pregnancies between 1990 and 1992 had ended in miscarriage, stillbirth, or infant death within the first year of life. In addition, a high number of other reproductive problems and birth defects were reported by the Tribe.

Although human health studies were being conducted by the Washington State Department of Health and the Indian Health Service, insufficient information existed to determine whether an environmental component to infant survival might exist. Additionally, Tribal members were concerned that their natural home, located along the shores of Willapa Bay in Southwestern Washington, was not safe. Tribal elders spoke of fish and shellfish that no longer inhabited their shores and of concerns about what might be hidden in the soils of a nearby dump. The Tribe felt their lives were integrally tied to the environment, and if the water, the wildlife and the fish were being threatened, so might their existence. As Herb Whitish, Chairman and tireless spokesman for the Tribe, said, "The Shoalwaters could be the proverbial canary in the mine for the entire Willapa Bay."

After meeting with the Tribe about their concerns, as well as with members of other federal, county and state agencies, EPA began a limited environmental assessment--to take a snapshot--of the quality of household drinking water, fresh and marine surface water, and various sediment routes which constitute important environmental exposure pathways for the Tribe and surrounding environs. Although EPA did not expect to find a direct link between environmental conditions and infant mortality, it was determined that there were many questions that scientists, environmentalists, business people, and Tribal members could not answer without this information.

In consultation with the Tribe and others, four specific pathways of potential environmental exposure were chosen for analysis: (1) drainage from a nearby abandoned dump; (2) agricultural runoff from cranberry farms, forestry and other sources; (3) tideflat sediments on or near Tribal lands, and (4) drinking water at Tribal household taps.

Between June, 1994 and March, 1996, EPA scientists and field staff gathered information, conducted on-site investigations, and analyzed samples at the EPA laboratory at Manchester, Washington. The quality of project data was established by strict adherence to all standard EPA laboratory protocols and data validation guidelines. In addition, the Tribe had some of the samples analyzed independently at a private laboratory.

Inasmuch as the study was dealing with issues so vital to the Tribe, results and an interpretation of their significance were communicated to them in person on a real time basis. Information was also directly communicated to the Shoalwater Health Concerns Advisory Committee for their review and integration with Tribal medical records and other health related data. EPA's Senior Toxicologist and project lead for this study serves as EPA representative to this Committee made up of scientists and medical doctors from eight different organizations throughout the country.

Of the four environmental pathways examined, drainage from cranberry bogs was the most troubling. Several pesticides found in the runoff in this area were at levels that exceed federal and state water quality standards. Risks to humans or animals that might wade in the ditch or drink surface water during periods of application are considerable, as are risks to "non target" species such as fish, aquatic birds, and small invertebrates.

For drinking water, low levels of total coliform bacteria were found at about 14 per cent of the households tested. Tests for fecal coliform and for the presence of chlorine led investigators to conclude there was insufficient chlorination to treat bacteria in some of the systems. Examination of water from household taps showed slight elevations for some "first-pour" samples--a typical response for older water delivery systems--but no violations of federal lead standards were observed.

Results from the dump site waste stream showed no obvious significant risks to human health or the environment.

Sediment samples from the tidflats were relatively clean. However, two compounds were found that mimic herbicide compounds not typically used in marine environments. One is not currently registered for use in the U.S. While the report concludes that these two compounds are most likely natural by-products of the marine environment, however further research to identify and characterize these compounds is recommended.

An important component of this study is the recommendation for further research in areas not covered by this limited investigation, and where concerns were identified. For example, two exposure pathways--air and ground water--were not examined. Vulnerable ground water resources under areas of pesticide application and runoff should be investigated. Likewise, air monitoring in targeted areas during pesticide and herbicide applications is needed. The report suggests further study of the long term ecological impacts of carbaryl and glyphosate applications, used to eradicate "ghost shrimp" and Spartina cord grass, respectively.

The report also recommends improved management practices, public education and technical assistance in such areas as drinking water, septic system operations and pest management.

As expected, this study did not uncover a direct link between infant mortality and environmental conditions. It did however, provide the Tribe reasonable assurance that the areas examined on and near the reservation were relatively clean and that others, like drinking water, could be improved by fairly simple procedures, such as chlorination and the flushing of tap water. Tribal concerns about the effects of pesticides and herbicides on the Willapa Bay ecosystem are given credence by the findings of the report. At this time, long term effects are unknown and further study is clearly needed.

This study represents science in its most human form--empathy for the fears of an under-represented, small group of people, concern about the effects of man's treatment of the landscape, and commitment to sound scientific methods. It reflects many hours of discussion with Tribal members and their staff, as well as consultation with scientists and environmental program specialists outside EPA Region 10.

Although the Shoalwater Tribe is the primary client for this work, it provided valuable experience for the Agency in terms of strengthening its cross-program focus and effectively utilizing in-house scientific talent. It may very well set a template for the Region and the Agency to more effectively and credibly address future complex multidisciplinary and ecosystem-driven health issues which lie "outside the box" of traditional EPA business.

Julie Hagensen,
Assistant Regional Administrator
for Washington Operations

ABSTRACT

The Shoalwater Bay Indian Reservation is located on Willapa Bay, an ecologically diverse but rapidly developing, multi-use Pacific Coast estuary. The Tribe has recently experienced various reproductive problems, typified by an unusually high infant mortality rate. As part of an ongoing evaluation conducted by various health agencies and experts, EPA Region 10 performed a screening assessment of four nearby environmental exposure pathways important to the Tribe. These included: (1) An abandoned dump drainage to a tidal slough, (2) various tideflat sites in the vicinity of the Reservation subject to occasional direct applications of pesticides under special permits, (3) drainage from nearby cranberry bogs receiving intensive pesticide application, and (4) drinking water at 42 stations including two wells and taps at 40 buildings.

Drinking water excepted, only a small number of environmental samples were taken. However, each sample was tested extensively for likely /relevant chemical and/or microbiological contamination. This study was intended to be a one-time sampling "snapshot", and was not designed to specifically examine other vital exposure pathways such as air and ground water.

Results revealed no specific environmental contamination to suggest a causal or contributory relationship to the Tribe's ongoing health and reproductive problems. At the dump site drainage, findings were not indicative of a contamination problem. However, the study did reveal some ongoing contaminant problems and issues in the Willapa Bay ecosystem which need to be addressed.

The most obvious environmental problem was pesticide contamination of surface water in runoff from cranberry bogs, where DDT, azinphos-methyl, chlorpyrifos, and diazinon were detected at excessive levels, some of which exceeded Federal and/or state water quality standards.

Intensive chemical residue analysis of tideflat sediments appeared unremarkable, except for the unexpected but pervasive findings--usually at levels of hundreds of ug/kg--of two "novel" bromo and iodo compounds: 4-hydroxy-3,5-dibromobenzoic acid, and its iodo analog. Mass spectral properties of the two compounds respectively resemble those of the two synthetic herbicides, bromoxynil and ioxynil, neither of which is known to be applied in the Willapa Bay area. Because of their ubiquitous presence at remarkably consistent levels-- from greatly divergent tideflat areas and at different timeframes (February and August)--they appear to be natural products, rather than deliberately introduced xenobiotics.

In all but one case, tideflat shellfish and overlying seawater collected from representative Willapa Bay and Tribal areas did not violate current standards for levels of enteric bacteria. However, surface water sampled near the Tribal "swimming hole" showed recent fecal contamination, possibly indicating a faulty septic system.

Drinking water lead concentrations at all household taps tested were all below EPA's lead action level of 0.015 mg/l, but a significant number were positive for total coliforms, indicating the need for better chlorination of delivery systems, both on and off-Reservation.

In screening for possible ecotoxicological effects in area shellfish, histopathological assays revealed no evidence of gonadal neoplasia among 51 samples of the softshell clam Mya arenaria obtained from the Tribal "swimming hole", and from the North River /Smith Creek inlet to Willapa Bay.

Several recommendations are made for further environmental research, technical investigations, and modifications in resource management practices. These specifically include screening for possible contaminants in local ground water and air, determining the identity and sources of the two novel halogenated tideflat compounds, improvement of drinking water delivery and sanitation containment systems, and developing better pesticide regulatory and management solutions for the area. Further studies are also recommended to address possible health and environmental risks of carbaryl and glyphosate, which are directly applied to local tideflat areas to respectively control "ghost shrimp", and invasive populations of Spartina cord grass.

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ACRONYMS

2,4-D	2,4-dichlorophenoxy acetic acid
Ans	anions
APHA	American Public Health Association
BMPs	best management practices
Cats	cations
CDC	Centers for Disease Control and Prevention
CFU	colony forming unit
Chrom.	chromatography
CIPC	isopropyl-3-chlorophenyl carbamate
<i>C. perfringens</i>	<i>Clostridium perfringens</i>
DBBA	4-hydroxy-3,5-dibromobenzoic acid
DBBN	3,5-dibromo-4-hydroxybenzonitrile
DIBA	4-hydroxy-3,5-diiodobenzoic acid
DIBN	3,5-diiodo-4-hydroxybenzonitrile
DOH	Department of Health
DQOs	data quality objectives
<i>E. coli</i>	<i>Escherichia coli</i>
EDTA	ethylene diamine tetraacetic acid
EPA	Environmental Protection Agency
FC	fecal coliforms
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FW	fresh water
GM	geometric mean
GPS	Global Positioning System
HPC	heterotrophic plate count
ICP/AES	inductively coupled plasma / atomic emission spectrometry
IHS	Indian Health Service
MCLGs	maximum contaminant level goals
MCLs	maximum contaminant levels
MDL	method detection limit
MHPC	marine heterotrophic plate count
MPN	most probable number
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
NAS	National Academy of Sciences
ORD	Office of Research and Development
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCP	pentachlorophenol
%	percent
PGDN	propylene glycol dinitrate
PST	Pacific standard time
PVC	polyvinyl chloride

QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
SBIT	Shoalwater Bay Indian Tribe
SBTC	Shoalwater Bay Tribal Council
SPS	sulfite polymyxin sulfadiazine
SQL	sample quantitation limit
SR	state route
TAL	Target Analyte List
TC	total coliforms
TCL	Target Compound List
TICs	tentatively identified compounds
TNT	2,4,6-trinitrotoluene
TOC	total organic carbon
Tot	total
VOCs	volatile organic compounds
WDOE	Washington State Department of Ecology

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Chapter 1.0 BACKGROUND

1.1 The Shoalwater Indians

The Shoalwater Bay Indian Tribe (SBIT) is a small group of Native Americans (about 155 members), many of whom live on or near their 1033 acres of Tribal trust land located in Pacific County, Washington, on the shores of Willapa Bay (1) (Figure 1). Based on the decennial census, 131 persons resided on the reservation in 1990. Rural and remote Pacific County, one of the poorest in the State, is also the home of about 500 other American Indian tribal members, with various other affiliations which include the Quinault, Quileute, Hoh, Chehalis, Makah, and other Pacific Northwest tribes. The Shoalwaters have historically sought to interact closely with their coastal ocean environment, and derive much of their subsistence and livelihood from activities which embrace and enhance natural resource utilization in the dynamic and productive Willapa Bay ecosystem.

1.2 Major Problems with Reproductive Health Outcomes: High Infant Mortality: Epidemiologic Studies Culminating with the "Joint Report" of the Shoalwater Bay Emergency

On July 7, 1992, news first emerged of an unusually high infant mortality rate among the SBIT (1),(2),(3). On that date, the Shoalwater Bay Tribal Council (SBTC) declared a health emergency on the reservation, due to a "high pre-natal and neonatal infant mortality rate, which may exceed 90 percent (%) for the last two years".

Following this announcement, a joint epidemiologic examination of adverse reproductive outcomes on the Reservation from 1982-1992 was initiated by the Portland Area Indian Health Service (IHS) and the State of Washington Department of Health (DOH) (2).

The preliminary draft report of this effort was then presented to the SBTC in October, 1993. By this time, the problem had expanded in scope as the research revealed various other chronic health problems among the Tribal population.

The controversial nature of such a topic met with strong perceptions and reactions among members of the Tribal community. This resulted in the Tribal Council recommending that the draft study be subjected to independent, outside scientific review. The Tribe asked three specific reproductive health scientists and the Centers for Disease Control and Prevention (CDC) to review the draft and suggest changes.

Through these efforts, the Washington State DOH and IHS preliminary report (2) was drafted into a more comprehensive and refined "Joint Report" (3), which incorporated changes suggested by reviewers, analysis of needs by the Advisory Committee, and perceptions and reactions by community members. The Advisory Committee reviewed and approved this Joint Report,

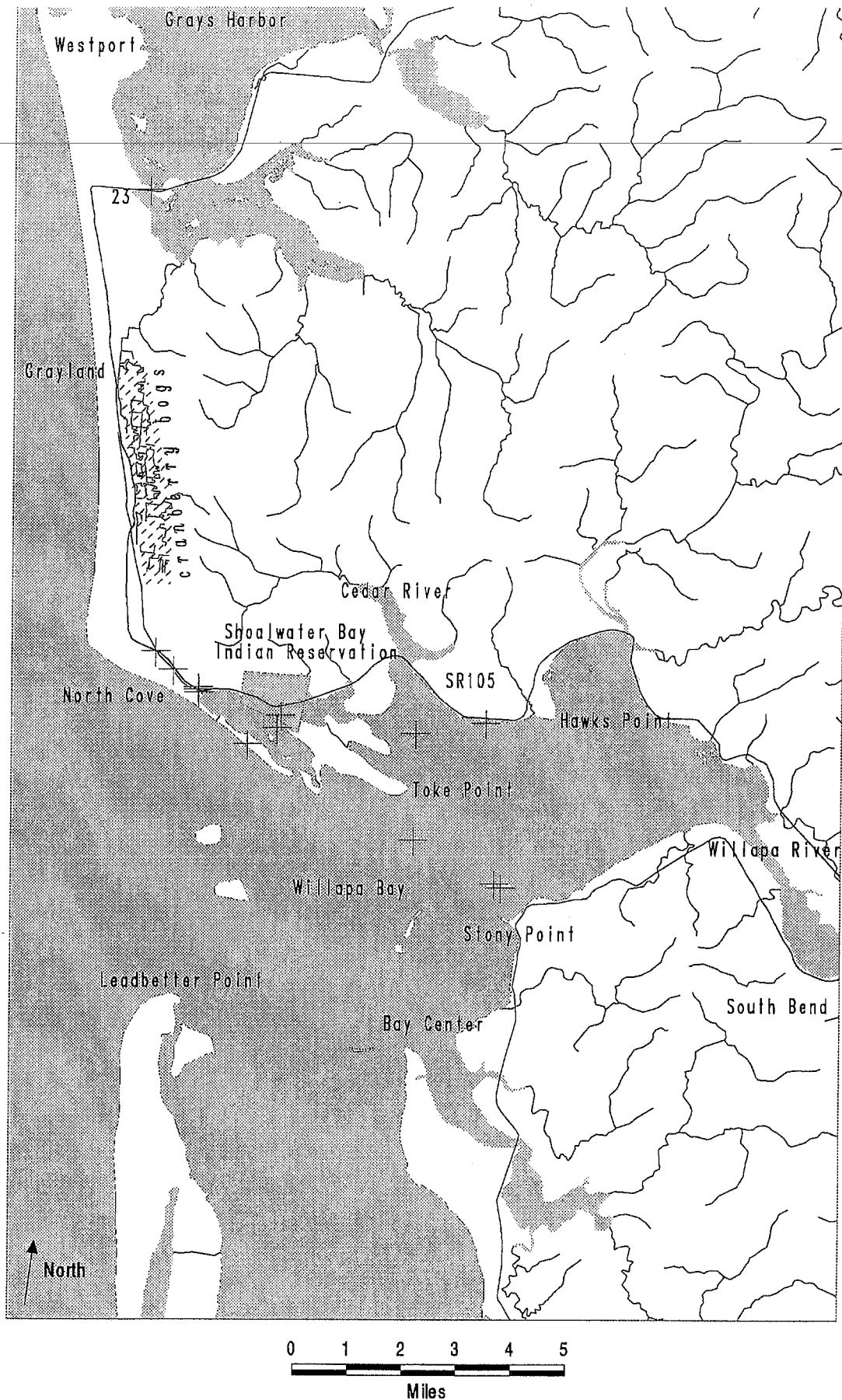


Figure 1. Location of the Shoalwater Bay Indian Reservation and project sample stations.

and it was also reviewed and approved by the SBTC on October 27, 1994. The final Joint Report, summarizing what was known about the Tribe's pregnancy and infant mortality emergency situation, was thus a joint effort of the SBTC, the Washington State DOH, and the IHS.

1.3 Findings of the Final Joint Report

The results of this Final Joint Shoalwater Bay Report were released in December of 1994 (3). The data corroborated Tribal concerns about high rates of on-reservation adverse reproductive health outcomes. Of nineteen on-reservation pregnancies identified for the Tribe between 1988 and 1992, only nine infants (47%) survived their first year of life. Statistically, the ten adverse outcomes /infant mortalities included three ectopic pregnancies (16%), three miscarriages (16%), two stillbirths (11%), and two infants (11%) who died before reaching their first birthdays.

Although the rates were based on small numbers, the severity of the problem of adverse outcomes of the on-reservation pregnancies between 1988 and 1992 can be roughly compared against the "expected" rates for Washington State as follows:

- The rate of stillbirths was 29 times the "expected" rate.
- The infant mortality rate was 24 times the "expected" rate.
- The rate of ectopic pregnancy for the Tribe was 10 times the "expected" rate.
- The rate of miscarriage was 1.2 times the "expected" rate.

1.4 Historically Inadequate Access to Health Care

The general health care situation for Native Americans is bureaucratically complex, highly compartmentalized, and often somewhat bleak. The IHS serves via its Portland office about 130,000 American Indians in Washington, Idaho, and Oregon, but receives congressional funds to support only 60% of tribal medical needs (1). There is thus a chronic limitation of adequate health facilities and care, and a corresponding limit on a given tribe's ability to plan and develop appropriate prevention programs. The IHS is also a "payer of last resort", which means that most of the time, the Shoalwaters have had to vacillate between state and federal government to receive health care. For the SBIT, such bureaucratic fragmentation meant that some of the health data for the Tribe was received by Medicare and some by IHS, leaving neither agency with a clear picture of the actual health crisis (1). The Final Joint Report noted that for the Shoalwaters, there was a "difference of access" to "a broad-based... delivery of personal and public medical and health care, and... community-based health promotion programs". Access to health care was identified as a major problem (even the major problem) (3).

Until the completion of their own modern on-site health clinic in 1995 (financed in part via a \$250,000 annual grant from Congress and a \$100,000 grant from the IHS), yet another problem for the Shoalwaters had been the necessity to drive northward about eighty five miles each way to the Taholah Clinic, which was the IHS-designated clinic for that service area. Once at Taholah, historic intertribal socio-political barriers made Shoalwater access to health services difficult.

1.5 Formation of the Shoalwater Bay Health Concerns Advisory Committee (May, 1994)

Along with the funding efforts and research initiatives outlined above, a special committee of medical, epidemiological, health care and environmental professionals was convened in Seattle on May 3, 1994. The function of this committee is to continually review and evaluate data and information relative to the Shoalwater's health crisis, and to advise and assist the SBIT in conducting health assessments, environmental testing, and educational outreach. The Committee meets quarterly, examines current issues and health /environmental data, and makes recommendations to Tribal leadership and management, including the five member Shoalwater Bay Tribal Health Board.

Members currently appointed to the Shoalwater Bay Health Concerns Advisory Committee are listed in Appendix A.

1.6 The Shoalwater Bay Tribal Health Board

To deal with this health emergency, and other health-based issues, the SBIT also relies heavily on its own internal Health Board. Members of the Health Board are frequent observers during the formal meetings of the Health Concerns Advisory Committee and are kept closely informed of the Committee's decisions and recommendations. Members currently appointed to the Shoalwater Bay Tribal Health Board are listed in Appendix B.

Chapter 2.0 INTRODUCTION

2.1 Possible Environmental Risk Factors: A Prelude to EPA's Involvement

The Joint Report did not reveal the existence or likelihood of any environmental "smoking gun". While the number of pregnancies investigated was too small to adequately assess environmental exposure, conclusions and recommendations of the Joint Report did, however, raise the possibility that environmental factors could play a role in the infant mortality problems experienced by the Tribe.

Many environmental risk factors are known to be associated with adverse pregnancy outcomes, including miscarriages. The original epidemiologic study by IHS and the Washington State DOH did not conduct environmental testing, but did ask Tribal respondents about a large number of variables potentially associated with environmental exposures. These included exposures from diet, drinking water sources (e.g., the main well which serves the Reservation), frequency of consuming locally harvested seafood, occupation (including maternal and paternal job exposures in local industries), and other sources such as exposure to pesticides, exposure to toxic substances through hobbies, etc. The frequencies of such exposures were similar among women with and without adverse outcomes. The original study did not do environmental tests for exposure to possible airborne, waterborne, or food borne toxins, or to toxins unknown to the women surveyed (2),(3).

Based on these uncertainties, the Report recommended that in addition to immediate and broad efforts to improve the quantity and quality of comprehensive health care, delivery of health care, and community health promotion, that "prudent environmental risk assessments and studies based on routes of exposure be conducted and collated with health assessments of tribal members". This EPA report is one element of the environmental risk assessment.

2.2 EPA Undertakes a Preliminary Environmental Study

By December 1994, public and news media attention had focused intently on the plight of the Tribe (4),(5),(6), further underscoring the need to obtain baseline screening data on possible environmental contaminants and exposure pathways in the area which might somehow be relevant to the Shoalwater Bay health crisis.

Since first becoming aware of the problem in 1993, EPA Region 10 had shared the Tribe's concerns. To respond to the concern that current environmental contaminants might be adversely impacting the health of the people of the Shoalwater Bay Indian Tribal Community, EPA Regional Administrator Chuck Clarke met with Chairman Herbert Mark Whitish at the Shoalwater Bay Tribal Headquarters on June 2, 1994. At that meeting, Administrator Clarke committed to a limited, but highly focused preliminary screening study to help explore the

possibility that Tribal exposure to various environmental stressors in the Shoalwater Bay ecosystem might somehow be related to these health and reproductive problems.

Chapter 3.0 SCOPE AND DESIGN OF EPA STUDY

The EPA investigation of four possible environmental pathways which might influence infant mortality and reproductive success was designed as a preliminary screening study, involving the relatively intense and specific investigation of targeted chemical residues in a small number of carefully chosen samples, from these exposure pathways.

Because funding for this screening effort was limited, the EPA study conducted no formal exposure modeling. Likewise, the intense investigation of a small number of environmental samples precluded a more "statistical" sampling design (involving many sample points, and correspondingly greater labor and expense). Rather than focusing on a large number of samples and analyzing in rote fashion for the more easily obtained, common environmental analytes, the EPA study went well beyond this approach in the laboratory, choosing instead to concentrate on specific and carefully selected analytes in a relatively few carefully chosen environmental samples.

3.1 Drainage From the Nearby Dump Site

For several years, the Shoalwater Bay Tribe had been concerned about the possibility of chemical exposure to their lands via drainage from an abandoned dump site (see Figure 2). This dump is located just inland from the tideflats across State Route (SR) 105, approximately two miles west-north-west of the Tribal Headquarters, and drains seaward via a series of small ravines and rivulets which drain this hillside area. The dump site and associated landfill had apparently not been fully characterized in terms of actual use history, and contents. The Tribe, which derives much of their subsistence on locally obtained fish and shellfish, was concerned about potential contamination from this dump significantly impacting the aquatic ecosystem immediately downstream.

For these reasons, it was decided to examine the lower leachate stream from this station for chemical contaminants. The Tribe was especially concerned about heavy metal contamination, munitions compounds, and antifouling paints which might have been dumped there.

The major surface leachate drainage from the dump site proceeds seaward via a small, year-round rivulet which runs along the base of the wooded ravine adjoining the dump. Flowing through a culvert under SR 105, the rivulet then drains to the upper intertidal area through a brackish slough. Drainage may flow directly to the tideflats during high tidal conditions, or indirectly by seepage through a salt marsh during low water conditions.

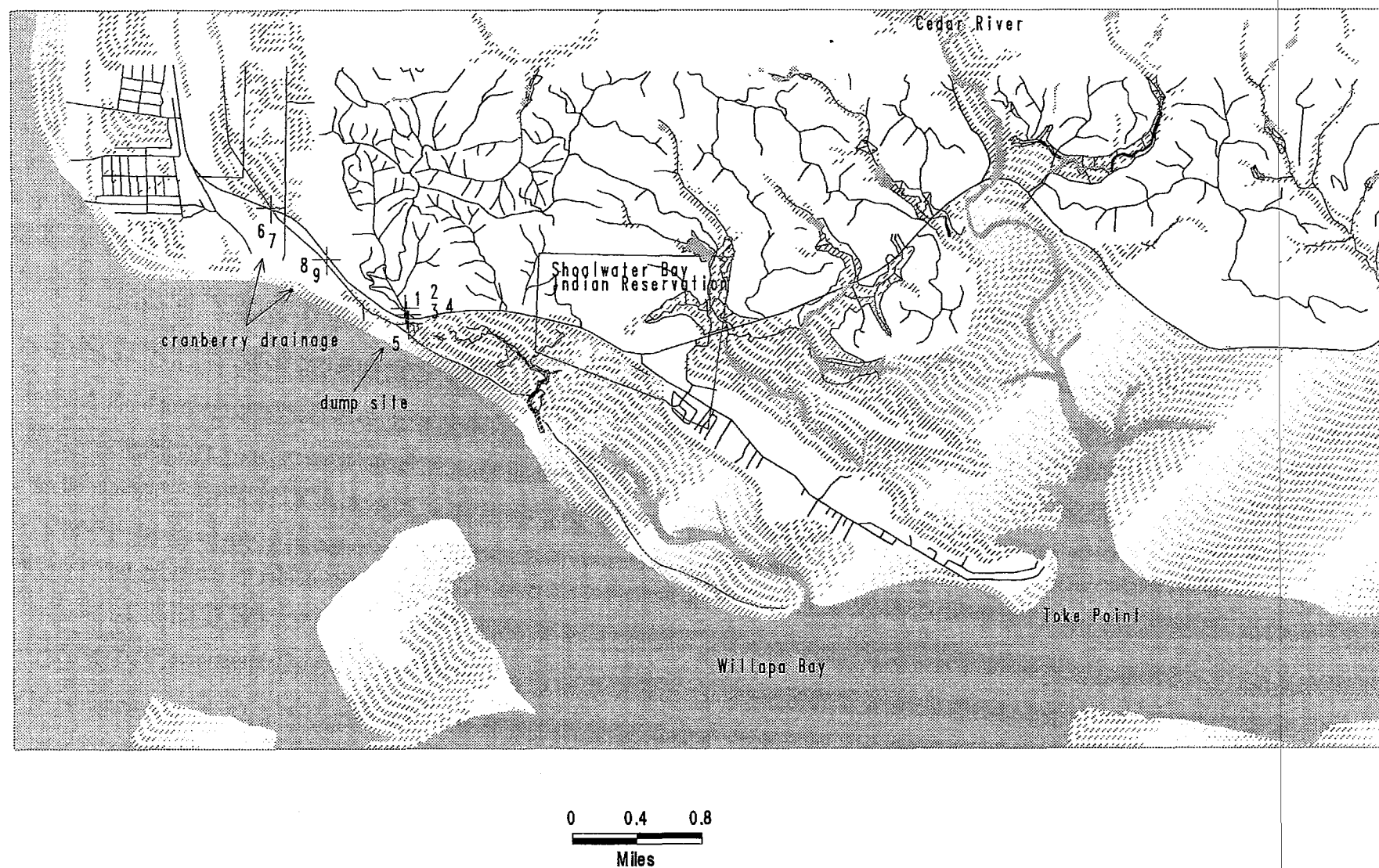


Figure 2. Sample stations in the drainage from the dump site and cranberry bogs near the Shoalwater Bay Indian Reservation.

3.1.1 Number and Type of Samples Taken

A total of five samples (Stations #1 - 5, Figure 2) were taken from along the dump site area drainage. These included three sediment and two water samples. One sediment sample was taken from an area of leachate discharging from the base of the dump, midway up the ravine. A second sediment sample was taken from the stream about 70 feet uphill from SR 105 and after the stream traversed the bottom area of the dump. A third sediment sample was taken from the slough across SR 105, which is the terminus of the drainage from the dump site. Two water samples were also obtained. These were taken at the same stations as the two sediment samples previously described from the mid and lower parts of the dump-ravine runoff. No concomitant water samples were taken from the supratidal slough area below the road.

3.1.2 Sediment Analytes of Concern

- Full target compound list (TCL) of organics and pesticides, and the target analyte list (TAL) of metals were measured.
- Also the following ordnance compounds:
 - 2,4,6-trinitrotoluene (TNT)
 - 2,4-dinitrotoluene
 - 2,6-dinitrotoluene
 - hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
 - propylene glycol dinitrate (PGDN)
- Specific metals and organometals:
 - tributyltin (and total tin)
 - methylmercury
 - beryllium

Detection Limit for Sediment: 100 µg/kg

3.1.3 Water Analytes of Concern

Analytes were identical to those listed above for sediment, but with the inclusion of major anions (chloride, fluoride, sulfate, and alkalinity), and nutrients (nitrate + nitrite, ammonia, and total phosphorus).

Detection limits for water: 10 µg/l, except

tributyltin; 1 µg/l
beryllium; 4 µg/l

3.2 Agricultural Runoff from Cranberry Bogs, Forestry, and Other Sources

The second area of EPA's concern about possible environmental contamination of the immediate Shoalwater Bay ecosystem focused on the general issue of pesticides from nearby agricultural sources. Immediately north and west of the Shoalwater Bay Tribal lands are areas of intense cranberry culture, as well as various types of forestry and other agricultural endeavors, both public and private. Approximately 800 acres are cultivated for growing cranberries in the near coastal area between Grays Harbor and Willapa Bay (7). Cranberries are grown in bogs, and spend nearly all of their growth cycle in saturated soil. Many pesticides are applied to these cranberry bogs, to control various pests and diseases which hinder crop production. On the Northwest Pacific Coast, rain and moist climates assure the transport of these pesticides offsite, from the bogs and from the forests adjoining them, via surface water drainage to Willapa Bay.

Agricultural chemicals which are used in or near wetland areas are especially difficult to contain on site, even under best management practices and ideal situations. Cranberries in particular are a "minor use crop", and consequently there are few commercial pesticides registered and designed especially for cranberry farming. Thus, cranberry growers must frequently seek permission to apply new pesticides under special or experimental registration permits issued from the State Department of Agriculture, responsible for administering and enforcing the EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of all pesticide products. Knowing this, and knowing that numerous pesticides are legally applied to the bogs during the growing season, samples were collected during the summer peak application period.

For the EPA sampling effort, it was decided to focus on a major drainage stream emerging from a very large area of numerous cranberry bogs, located just between the coastal forest and SR 105, about two miles northwest of Tribal Headquarters (Figure 2.). After leaving the bogs, the stream proceeds southward between SR 105 and the ocean, and finally discharges to Willapa Bay at a point about a mile northwest of the Tribal Headquarters. For screening purposes, the samples were taken under what were perceived as "worst case" conditions; i.e., during the summer period of greatest pesticide application, and at stations specifically chosen to reflect areas of high pesticide loading as a consequence of upstream agriculture practices. Concomitant samples of sediment and water were taken at two points along a common drainage stream exiting a major bog area, as it made its mile-long progression to the nearby tidelands.

3.2.1 Numbers and Types of Samples Taken

A total of four samples were taken from the area draining this intense agricultural area (Stations #6-9, Figure 2). These consisted of two sediment and two water samples from the overlying water column. One set of samples was taken just north of SR 105, where the stream exits nearby cranberry bog properties. The second set of samples was obtained about one half mile downstream, where the stream becomes tidally influenced, and about one quarter mile onto the intertidal shoreline.

Because these samples targeted the most likely conditions for agricultural pesticide contamination, chemical analyses were directed toward on a suite of carefully chosen pesticide residues likely to be used in such endeavors as cranberry culture, forestry, and general agriculture.

3.2.2 Sediment Analytes of Concern

- Full pesticides screen, including the organochlorine and organophosphate series.
- Also, special emphasis was placed on certain analytes associated with cranberry bogs and forestry areas, to specifically include the following:

esfenvalerate
chlorpyrifos
azinphos-methyl
dimethoate
phosmet
diazinon
malathion
carbofuran
endosulfan
carbaryl
1-naphthol
acephate
mancozeb
ferbam
chlorothalonil
2,4-D
Dichlobenil
simazine
hydroxysimazine
atrazine
diuron
pronamide
glyphosate
hexazinone
dalapon
norflurazon
napropamide
pentachlorophenol, (PCP)

- Metals

total lead
total mercury
arsenic

Detection Limits for Sediment: 100 µg/kg

3.2.3 Water Analytes of Concern

As above for sediment, with the inclusion of

- Metals, anions, and nutrients as outlined for surface waters taken from the dump site pathway described previously.

Detection Limits for Water: 10 µg/l

3.3 Tideflat Sediment in the Vicinity of the Shoalwater Bay Indian Tribal Lands (See Figure 3)

The possibility of chemical pollutants in the tidelands near the Reservation has long been a concern of area residents. These concerns are well-founded. Although the Willapa Bay ecosystem is a dynamic and well-flushed estuary, its wealth of natural resources are sought after, and managed, by an increasingly greater and complex array of various private and public interests. Accordingly, there are numerous known sources of xenobiotic contaminants which conceivably can enter areas where subsistence on local fish and shellfish is important to local residents.

For example, considerable portions of the tidelands adjacent to the Shoalwaters have historically been sprayed each year with the pesticide, carbaryl. Applied under a special State permit, carbaryl controls the populations of ghost shrimp, of the genera *Neotrypaea* (formerly *Callinassa*) and *Upogebia*, which interfere with oyster production because their burrowing activities can bury or smother oysters (8). Also, herbicides such as glyphosate are applied in certain areas of the Bay, to control invasive stands of the non-native seagrass, *Spartina*. There is also considerable local concern about herbicides and other pesticides entering the Bay from roadside applications around its periphery, from forestry operations in the area, and from other agricultural runoff in the region.

Possible contamination from the Columbia River is another source of concern. The Columbia, laden with agricultural and industrial pollutants pours into the Pacific fifty miles down the coast. The Tribe contends that the Columbia River Gyre, a vast eddy driven northward along the coast in its clockwise Coriolis rotation, dumps a significant portion of this pollutant load directly into their portion of Willapa Bay.

For these reasons, it was decided to select a small number of carefully chosen sediment samples from the tidelands adjacent to the Tribal lands, and analyze them extensively for possible chemical residues. At this preliminary stage, only sediments were sampled and analyzed; no samples of benthic biota were taken.

3.3.1 Number and Types of Samples Taken

A total of five sediment samples were obtained from preselected representative areas of the inshore tidelands of Willapa Bay (Stations #10-14, Figure 3). Results of the initial sampling prompted the collection of a similar sediment sample from Grays Harbor, a separate, hydrogeologically similar estuary to the north, for purposes of comparison (Station #23, Figure

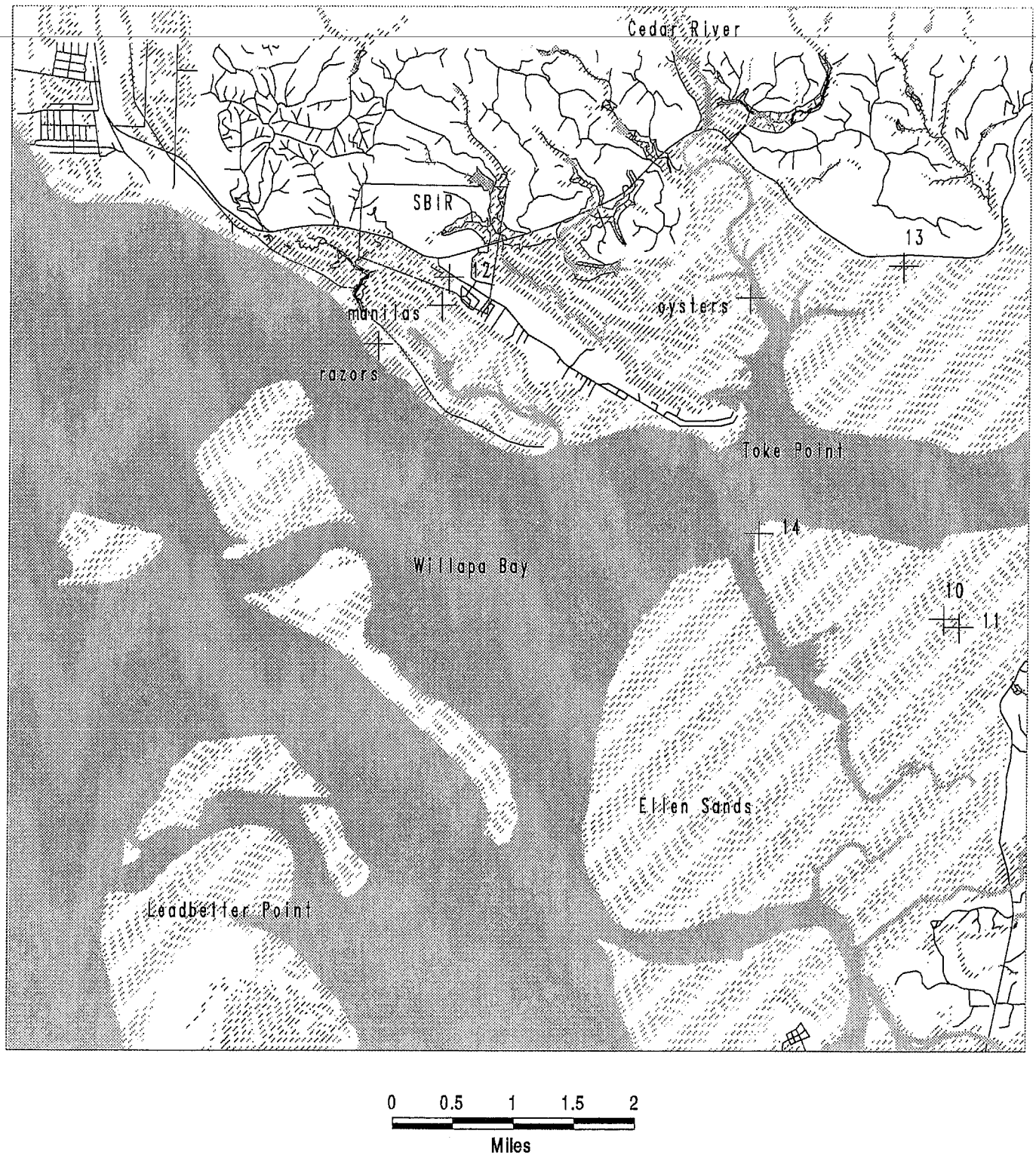


Figure 3. Tideflats sample stations in the vicinity of the Shoalwater Bay Indian Reservation (SBIR).

1). Specific details about the sampling stations and results of analysis are outlined in later sections of this report.

3.3.2 Sediment Analytes of Concern

- Full TCL organics and TAL inorganics, including metals, routine pesticides (including organophosphate and organochlorine screen), organics. Detection limits: 100 µg/kg.
- The following metals and organometals:
 - total lead
 - total mercury
 - arsenic
 - tributyltin (and total tin)
 - methylmercury (and total mercury)
- Glyphosate
- Special pesticide screen, to include:
 - esfenvalerate
 - chlorpyrifos
 - azinphos-methyl
 - dimethoate
 - phosmet
 - diazinon
 - malathion
 - carbofuran
 - endosulfan
 - carbaryl
 - 1-naphthol
 - acephate
 - mancozeb
 - ferbam
 - chlorothalonil
 - 2,4-D
 - dichlobenil
 - simazine
 - hydroxysimazine
 - atrazine
 - diuron
 - pronamide
 - glyphosate
 - hexazinone
 - dalapon
 - norflurazon
 - napropamide
 - PCP

Detection Limits, Sediment: 100 µg/kg

3.3.3 Microbiological Screening: Two Intertidal Water Samples

Recently, there has been a concern that fecal contamination from failing septic drainfield systems may be leaking onto the beach in the vicinity of the tribal "swimming hole". EPA evaluated two intertidal water samples for fecal coliforms, *enterococci*, *E. coli*., and *Pseudomonas aeruginosa* concentration. Samples were obtained during an incoming tide. One sample (Dexter-by-the-Sea; see Figure 4) was chosen as the station nearest the actual swimming hole. The second sample was located north of the swimming hole and at a station of potential fecal contamination.

3.4 Drinking Water Stations in the Vicinity of the Shoalwater Bay Indian Reservation

As part of this EPA preliminary screening study, a drinking water survey of selected on- and off-reservation water system taps was conducted in October 1995. The intent of the sampling event was twofold. The first goal was to screen drinking water for bacteria, lead, or other inorganic contaminants. The second goal was to provide the Tribe additional information useful for designing a more comprehensive drinking water investigation. The drinking water sampling event supplements earlier work, including a 1993 EPA analysis of synthetic organic compounds in the main tribal water-supply well (9),(10),(11).

Contaminants in drinking water can originate in the water source (such as ground water or surface water), in the distribution system between the source and the residence, and in the residence distribution system. Most residences and community buildings were sampled for bacteria and lead, because these parameters are more likely to vary as a result of conditions in and around the distribution systems. For example, lead can originate from leaded pipes, solder or packing. Bacterial contamination can originate by infiltration from failing septic drainfields or some other bacterial source into the distribution pipes. A fewer number of stations, but still sufficient to include most water sources used by tribal members, were sampled for complete inorganics (metals, anions, and nutrients). Inorganic parameters other than lead are likely to vary as a result of conditions in the different ground water or surface water sources rather than in the distribution systems.

The study area for the survey encompassed tribal residences and community or business stations on the Shoalwater Bay Indian Reservation and in or near Dexter-By-The-Sea, Ocosta, Westport, Grayland, South Bend and Bay Center. The water sources that serve these distribution systems are listed in Table 1. In all, 42 stations were sampled for one or more of three suites of parameters: bacteria, lead, or complete inorganics. Of the 42 stations, 36 stations were sampled for bacteria, 32 stations for lead, and 19 stations for complete inorganics.

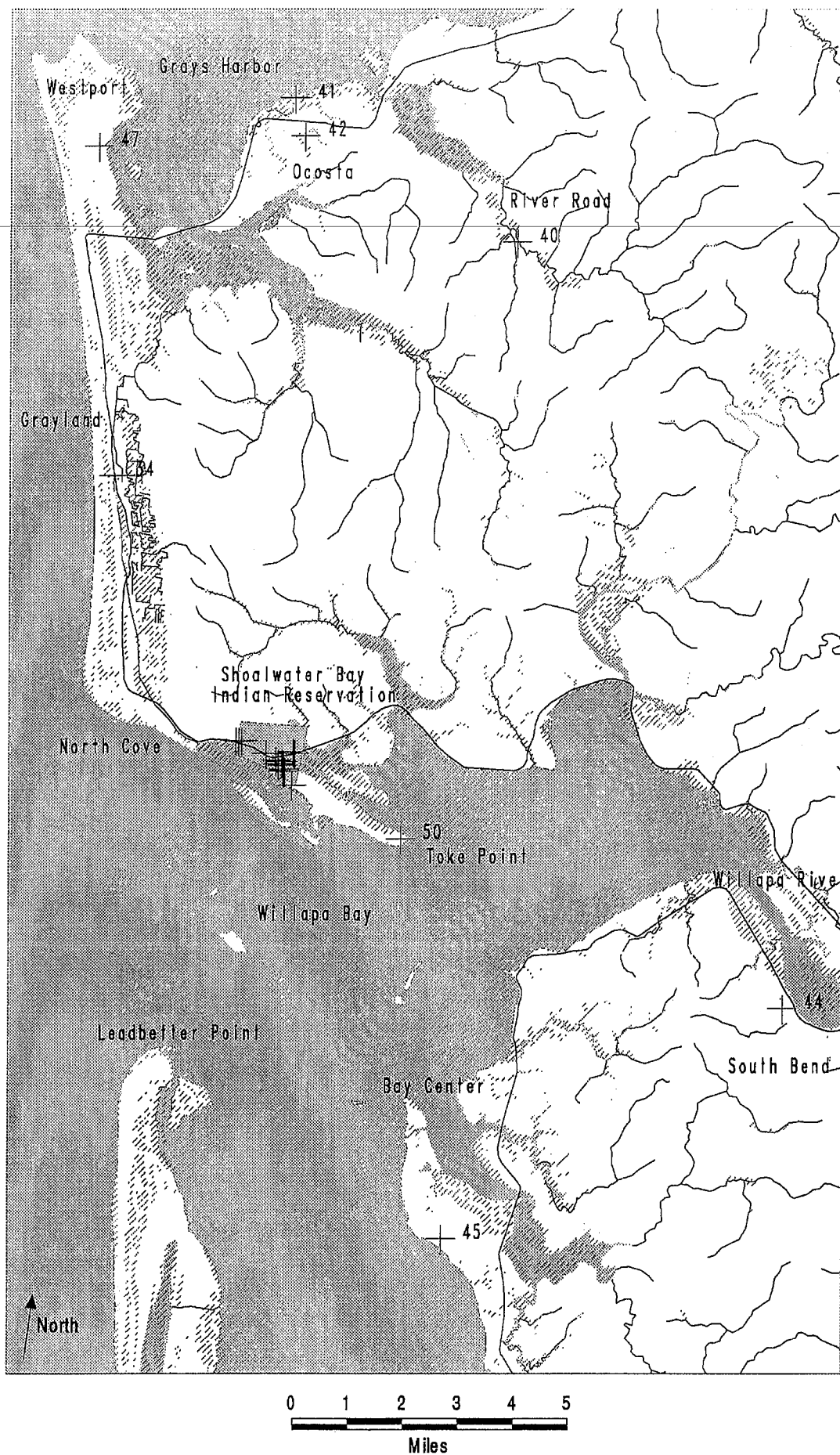


Figure 4. Sample stations for drinking water survey. Outlying sites are numbered; see Figures 7 and 8 for detail near the reservation.

Table 1. Sources of Drinking Water Samples

Water Source	Service Location
Main Reservation Well	Most Reservation Buildings
Annex Well	Annex Buildings
Dexter-By-The-Sea Community Well	Buildings Near East Boundary
Toke Point Well	Horse Pasture
Grayland Community Well	Grayland Residences
Westport Community Well	Westport Residence
Private Wells	Ocosta Residences
Private Well	Bay Center Business
Surface Water Community Source	South Bend Residence

Chapter 4.0 FIELD ACTIVITIES AND METHODOLOGIES

This field screening study involved: (1) sediment, water, and microbiological samples at an abandoned solid waste disposal site; (2) sediment and microbiological samples from a water recreation area; (3) a reference sediment sample from South Bay in Grays Harbor; (4) sediment and water samples in a drainage ditch from a cranberry growing area; (5) sediment, water, or microbiological samples in five shellfish harvesting areas in Willapa Bay; and (6) a drinking water survey. Sediment, water, drinking water and tissue samples were collected and analyzed for a variety of organic, inorganic, trace metals and microbiological parameters depending on the potential threat from the pathway in question. The location of the sample stations, other than the drinking water samples, in and near the Reservation is shown in Figures 1 - 3. The location of drinking water samples is shown in Figures 4-6.

The abandoned solid waste disposal site is located on the west side of an unnamed stream that enters North Cove on the west side of the reservation. The site is on the side of a low hill and starts about 1/4 mile north of SR 105, and extends about 1/4 mile north along the right bank of the stream. Debris from the dump is scattered throughout the flood plain and is also in the active flowing stream.

The water recreation area is located on the Reservation just north of the new tribal center and close to a housing area. It is referred to as a swimming hole, but swimming is only possible at high tide. However, this area is sometimes used for wading by young children during low tide. The Reservation hardshell clam bed is located about 1/4 mile to the south of the swimming hole.

The drainage ditch from the cranberry growing region enters Willapa Bay just west of North Cove. The ditch is nearly 5 miles long and drains cranberry bogs located south of the Pacific/Grays Harbor County line.

The five most commonly used shellfish harvesting areas are: (1) commercial oyster beds on the south side of the Willapa River Channel and north of Stony Point, (2) the Hawks Point hardshell clam beds, (3) an oyster bed located on the west side of the Cedar River channel, (4) a hardshell clam bed on the Reservation, and (5) a razor clam beach at North Cove.

The drinking water sampling event was conducted primarily at residences on the reservation, but also included off-reservation tribal members' residences in nearby communities of Dexter-By-The-Sea, Grayland, Westport, Ocosta, and South Bend. Samples for the drinking water survey were also collected from two tribal wells and from the Shoalwater Bay Oyster Company near Bay Center.

4.1 Sample Collection

The location, media, analysis required, sample type, and the sampling dates for the water and sediment samples are listed in Table 2. Similar information is shown on Tables 3 and 4, respectively, for the microbiological and drinking water samples.

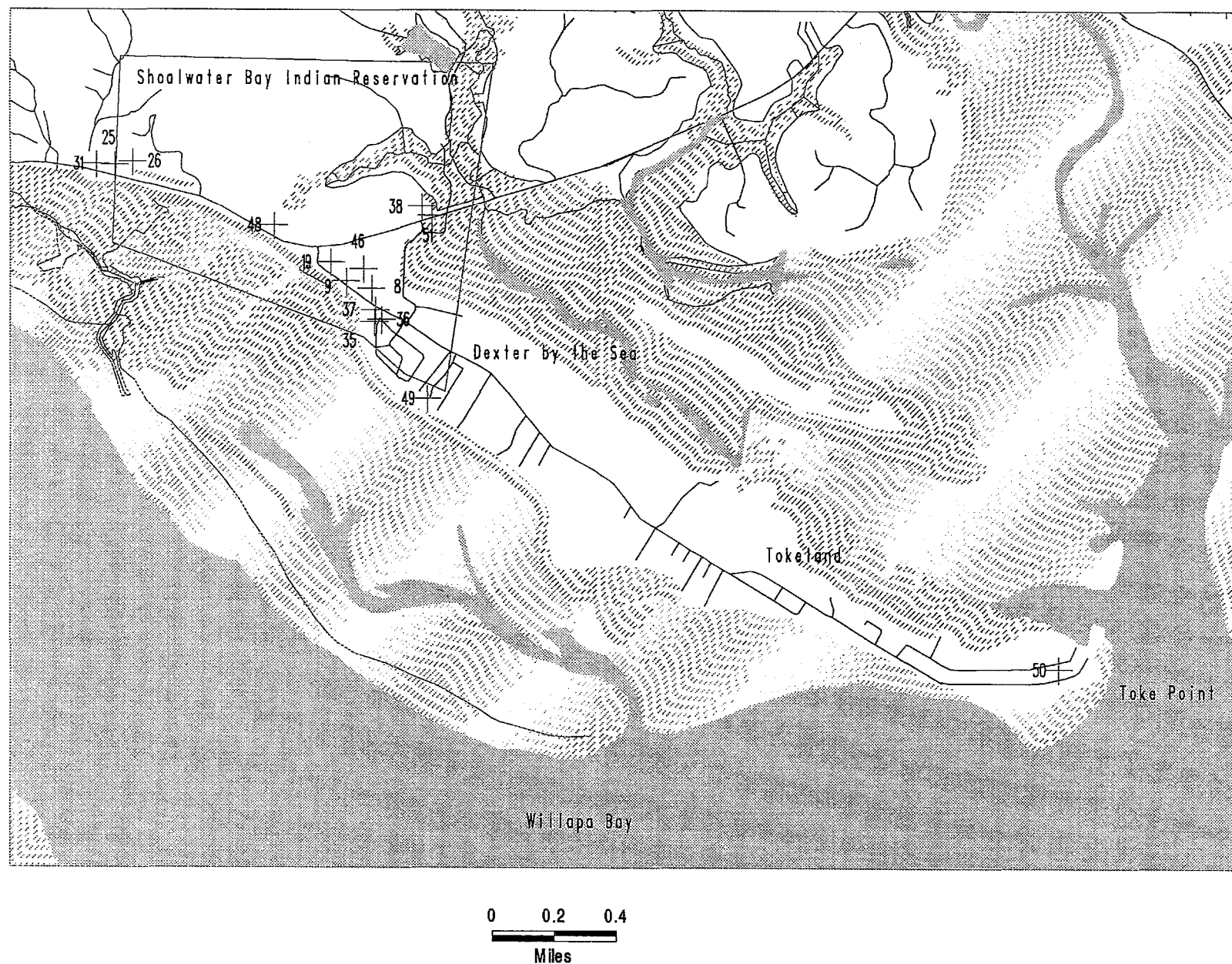


Figure 5. Sample stations for drinking water survey in the vicinity of the Shoalwater Bay Indian Reservation

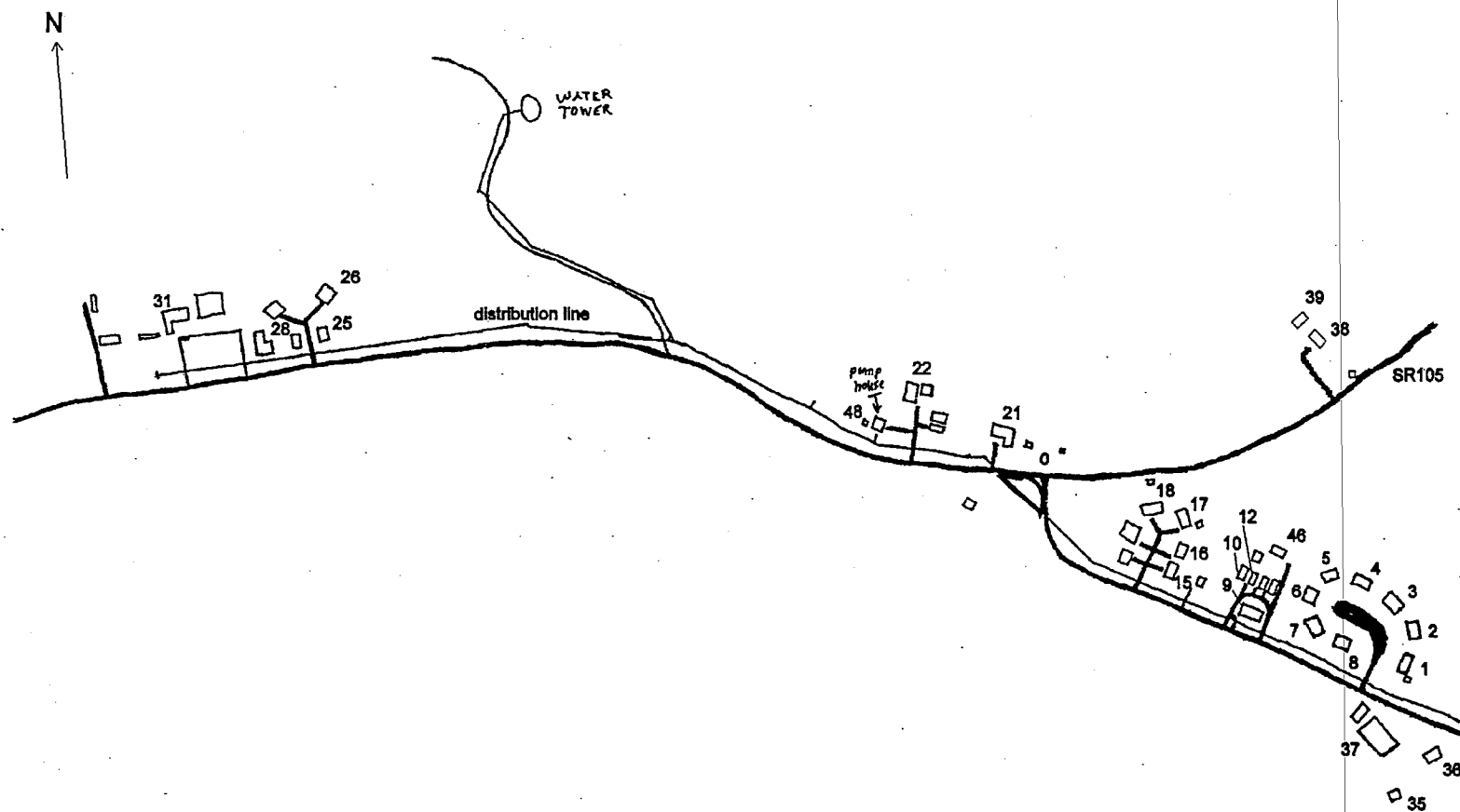


Figure 6. Sample stations for drinking water survey at the Shoalwater Bay Indian Reservation. Not to scale; area shown is approximately one mile across.

Table 2. List of Sediment and Surface Water Samples¹

Station Number	EPA Sample Number	Location	Media	Analysis Required	Date Sampled
1	95080025	Dump Site	Sediment	Org, TOC & Metals	02-22-95
2	95080026	Dump Site, Leachate	Water	Organics & Metals	02-22-95
3	95080023	FW Stream, Below Dump Site	Sediment	Org, TOC & Metals	02-22-95
4	95080024	FW Stream, Below Dump Site	Water	Organics & Metals	02-22-95
5	95080021	Estuary, Upper Beach Lagoon	Sediment	Org, TOC & Metals	02-22-95
6	95240100	Upper Cranberry Ditch	Sediment	Metals	06-13-95
6	95240101	Upper Cranberry Ditch	Sediment	Organics	06-13-95
7	95240103	Upper Cranberry Ditch	Water	Pesticides/PCBs	06-13-95
7	95240105	Upper Cranberry Ditch	Water	Ans/Cats/Nutrients	06-13-95
7	95240104	Upper Cranberry Ditch	Water	Herbicides	06-13-95
7	95240102	Upper Cranberry Ditch	Water	Metals	06-13-95
8	95240106	Lower Cranberry Ditch	Sediment	Metals	06-13-95
8	95240107	Lower Cranberry Ditch	Sediment	Organics	06-13-95
9	95240111	Lower Cranberry Ditch	Water	Ans/Cats/Nutrients	06-13-95
9	95240110	Lower Cranberry Ditch	Water	Herbicides	06-13-95
9	95240109	Lower Cranberry Ditch	Water	Pesticides/PCBs	06-13-95
9	95240108	Lower Cranberry Ditch	Water	Metals	06-13-95
10	94334301	Willapa Bay, Oyster Bed	Sediment	Organics & Metals	08-19-94
11	94334302	Willapa Bay, Oyster Bed	Sediment	Organics & Metals	08-19-94
12	94334303	SBIR, Swimming Hole	Sediment	Organics & Metals	08-19-94
12A	95080022	SBIR, Swimming Hole	Sediment	Org, TOC & Metals	02-22-95
13	94334304	Hawks Pt, Shellfish Area	Sediment	Organics & Metals	08-19-94
14	94334300	Willapa Bay, Ellen Sands	Sediment	Organics & Metals	08-19-94
23	95080020	Grays Harbor, South Bay	Sediment	Org, TOC & Metals	02-21-95

¹ - All samples were grab samples.

Table 3. List of Microbiology Samples¹

Station Number	EPA Sample	Location	Media	Date Sampled
12	94350125	SBIR, Swimming Hole, near Dexter-by-the-Sea	Water	08-29-94
12	94350126	SBIR, Swimming Hole, near Davis House	Water	08-29-94
15	95080031	Dump Site Leachate	Water	02-22-95
16	95080032	FW Stream, Above Dump Site	Water	02-22-95
16	95080030	FW Stream, Below Dump Site	Water	02-22-95
17	95200021	Tideflat near Cedar River, Oyster Bed	Oyster Tissue	05-18-95
17	95200020	Cedar River on Tideflat	Water	05-18-95
18A	95200025	SBIR, Shellfish Harvesting Area	Littleneck Tissue	05-18-95
18A	95200024	Pooled Water on Tideflat	Water	05-18-95
18B	95200023	Willapa Bay, North Cove Beach	Razor Clam Tissue	05-18-95
18B	95200022	Nearshore Willapa Bay	Water	05-18-95

¹ - All samples were grab samples.

Table 4. List of Drinking Water Samples Collected in October, 1995.

Station Number	Location	EPA Sample Number	Date Sampled	Time, (pst)	EPA Sample Number	Date Sampled	Time (pst)	EPA Sample Number	Date Sampled	Time (pst)
		Inorganics			Lead			Microbiology		
1	Reservation-east				95430559	951030	am	95430603	951023	1200
2	Reservation-east							95430604	951023	1210
3	Reservation-east				95430557	951028	am	95430605	951023	1216
4	Reservation-east				95430539	951023	am	95430606	951023	1223
5	Reservation-east				95430561	951025	am	95430607	951023	1230
6	Reservation-east				95430534	951023	am	95430608	951023	1234
7	Reservation-east				95430537	951023	900	95430609	951023	1242
8	Reservation-east	95430508	951023	1440	95430550	951023	am	95430610	951023	1250
9	Reservation-east	95430501	951023	1225	95430545	951024	600	95430611	951023	1302
10	Reservation-east				95430530	951023	am	95430612	951023	1305
12	Reservation-east				95430531	951023	am	95430613	951023	1310
14	Reservation-east				95430532	951023	am	95430614	951023	1330
15	Reservation-east				95430536	951023	640	95430617	951023	1510
16	Reservation-east				95430556	951027	am	95430618	951023	1520
17	Reservation-east				95430549	951024	545	95430619	951023	1535
18	Reservation-east				95430560	951025	am			
19	Reservation-east	95430503	951023	1330	95430538	951023	715	95430620	951023	1530
20	Reservation-east				95430540	951023	605	95430621	951023	1545
21	Reservation-center							95430622	951023	1600
24	Reservation-center				95430546	951024	am	95430623	951023	1620
25	Reservation-west				95430548	951024		95430625	951023	1640
26	Reservation-west				95430547	951024	700	95430626	951023	1650
28	Reservation-west				95430558	951029		95430624	951023	1635
31	Reservation-west	95430502	951024	1245	95430552	951024	am	95430627	951023	1700
32	Westport							95430631	951024	850
33	Westport				95430533	951023	am	95430633	951024	945
34	Grayland	95430520	951024	1450	95430535	951023	530	95430634	951024	1015
35	Reservation-Dexter	95430516	951024	1200				95430601	951023	1135
35	Reservation-Dexter	95430517	951024	1202						
36	Reservation-Dexter	95430500	951023	1150				95430600	951023	1125
37	Reservation-east	95430507	951023	1415				95430602	951023	1146
38	Reservation-annex	95430504	951023	1323	95430551	951024	am	95430616	951023	1500
39	Reservation-annex	95430505	951023	1320	95430542	951024	am	95430615	951023	1450
40	Ocosta	95430509	951023	1535	95430543	951023	am	95430630	951023	1820
41	Ocosta	95430510	951023	1615	95430554	951023		95430628	951023	1750
42	Ocosta	95430511	951023	1635	95430555	951023		95430629	951023	1800
44	South Bend	95430514	951024	1010	95430544	951024	am	95430635	951024	1120
45	Bay Center	95430515	951024	1045						
46	Reservation-east	95430518	951024	1225	95430553	951024	1220			
47	Westport	95430512	951023	1705	95430541	951023		95430632	951024	915
48	Reservation-center	95430506	951023	1345						
49	Tokeland	95430513	951024	715						
50	Reservation-Tokeland	95430519	951024	1300						
51	Reservation-annex							annex well		
	transfer blank	95430521	951024	1450				95430636	951023	2020
	transfer blank							95430637	951024	1135

All samples were transported in insulated coolers containing crushed ice and analyzed at the EPA Manchester Laboratory. These samples were transported, stored, and analyzed according to specifications of the Quality Assurance Project Plan (QAPP).

4.1.1 Sediment

Surface sediment was collected either with a precleaned stainless steel spoon or, for some of the water areas, with a precleaned Ekman dredge (dimensions 6"x6"x9" deep). The Ekman dredge was thoroughly brushed and rinsed with on-site and deionized water between samples. An attempt was made to sample the top six inches of sediment, but at some stations this was not possible due to the sediment type (clay, root masses, or soft substrates) or due to visual limitations when sampling below water with the Ekman dredge. When the Ekman dredge was used for sampling, sediment was removed from the dredge with a precleaned stainless steel spoon. Only sediment not touching either the sides or the bottom of the dredge was collected for analysis.

For the estuarine sediment samples above water, a clear plastic core (10 cm in diameter by 20 to 25 cm long) was taken adjacent to each sample station to obtain a field description of the substrate, i.e., color, stratification, organic material and odor. Sediment from the descriptive cores was not sampled for analysis.

Sampled sediment was initially placed in precleaned 1-gallon jars. The jars were filled approximately two-thirds full and mixed to an even color and consistency with a precleaned stainless steel spoon. Mixed sediment from these containers was then placed in separate precleaned jars for the required analyses at that station and for providing split samples for the Tribe's Environmental Program.

4.1.2 Water

4.1.2.1 Surface Water

The surface water samples were taken in precleaned glass jars or cubitainers appropriate for the analysis required. The containers were filled with water at each station either by direct immersion under the surface or with a precleaned 8-oz jar used as a ladle for filling larger containers. Any surface debris (e.g., floating algae, leaves, twigs, etc.) was brushed aside during sampling. Separate water samples were taken for the Tribe.

Field parameters (pH, conductivity, and temperature) were measured at the time of sampling. In addition, a conductivity survey was made of the stream adjacent to the dump site. The purpose of the survey was to measure conductivity variations that would indicate an increase in dissolved solids resulting from seepage from the base of the dump into the stream.

4.1.2.2 Drinking Water

Three groups of samples were collected for the drinking water sampling event (Table 4): first-pour samples for lead analysis, flushed samples for complete inorganics, and flushed samples for microbiology. Microbiological methods are described below.

First-pour samples for lead analysis (Table 4) were collected from 32 stations by residents using 500-ml polyethylene cubitainers. Residents were provided a written protocol for collecting a sample early in the day from a tap commonly used for drinking water, generally the kitchen tap. The protocol specified collecting water prior to any other water use for the day to ensure that the sample was worst-case in terms of prolonged stagnation time in household pipes. The residents delivered their samples to a central receiving point during October 23-24, 1995, at which time field pH and conductivity were measured and the sample was preserved. Five of the samples were collected after the field survey and were subsequently mailed to the laboratory.

Flushed samples for complete inorganic analyses (Table 4) were collected from 20 stations by an EPA team. These samples were collected in polyethylene cubitainers after purging the tap for at least one minute. Field parameters (pH, conductivity, and temperature) were measured at the time of sampling, and samples were immediately preserved for metals analysis. Since the flushed samples were collected later in the day after a period of normal water use, the sample water should have had minimal residence time in the household pipes, and should have been more representative of water from the outside distribution system. In addition to building taps, samples were collected from two well heads: the main tribal water-supply well and a tribal well near Toke Point (Figure 5).

In order to test field conditions during the drinking water sampling event, a duplicate QA sample was collected at one station. In addition, a transfer blank was also collected at one station, for which laboratory- prepared deionized water was transferred in the field from one bottle to another.

4.1.3 Microbiology

4.1.3.1 Field Methods

All bacteriological samples of freshwater, seawater and leachate seep water were collected according to EPA and American Public Health Association (APHA) methods (12),(13),(14),(15) using sterile 250 ml or 500 ml polypropylene bottles containing the appropriate preservative. Leachate seeps and freshwater from the dump site were collected in bottles containing a chelating agent (0.3 ml of a 15% ethylene diamine tetraacetic acid (EDTA) /125 ml sample volume). All other freshwater samples, including drinking water, were collected in bottles containing a dechlorinating agent (0.1 ml of a 10% sodium thiosulfate solution/125 ml sample volume).

Shellfish samples consisting of Pacific oysters (*Crassostrea gigas*), Japanese littleneck clams (*Tapes japonica*) and razor clams (*Siliqua patula*) were collected according to APHA shellfish procedures (13) in sterile plastic bags. Ambient estuarine surface water was collected near each shellfish bed by immersing a polypropylene bottle below the water surface.

Freshwater, leachate, shellfish and seawater samples were examined within eight hours of collection, and the drinking water samples were examined within 30 hours of collection.

4.1.3.2 Laboratory Methods

Drinking water samples were analyzed by the membrane filter method following EPA criteria (12) for the enumeration of total coliforms, fecal coliforms and *E. coli*. All other samples, including shellfish tissue, were examined using the five-tube, multiple dilution MPN method outlined in both Standard Methods (15) and APHA shellfish procedures (13). Enterococci were determined by the same MPN procedure as described above using azide-dextrose broth for presumptive growth and Enterococcosel® Agar for confirmation as described in Standard Methods (12). All final counts for total coliforms, fecal coliforms, *E. coli* and enterococci were based on a per 100 ml/gm basis.

Samples of leachate and freshwater from the dump site were examined by the heterotrophic plate count (HPC) and sulfite polymyxin sulfadiazine (SPS) aerobic/anaerobic procedure developed by the EPA Manchester Laboratory (16). All final counts of HPC and SPS were expressed on a 1 ml or 1 gm basis.

4.2 Station Locations by Global Positioning System

The position of each station was determined by using a global positioning system (GPS) in the autonomous (non-differentially corrected) mode. The positions of all stations, except for stations 10, 11, 13 and 14, were post-processed to obtain final positions accurate to within ± 3 meters. Due to limited sampling time, position files were not recorded for stations 10, 11, 13 and 14. Further, in some other cases, e.g., stations 1, 2, 3, 4, 8 and 9, the recorded position was some distance away from the station location, which was under a canopy of vegetation. The post-processed and uncorrected GPS station positions are listed in Appendix H, Table H-1.

Chapter 5.0 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

Quality assurance/quality control (QA/QC) requirements for the project were specified in two QAPPs (17),(18). For preparation of this report, each QAPP was reviewed in order to determine if project objectives and project data quality objectives had been met.

5.1 Project Objectives and Data Quality Objectives (DQOs)

The above referenced QAPPs state the following project objective:

- **Conduct a Preliminary Field Screening Study to:**
 - 1) Evaluate a broad spectrum of organics, pesticides, and trace metals in selected sediment and water samples,
 - 2) Evaluate microbiological contamination of water and shellfish near the Shoalwater Bay Indian Reservation, and,
 - 3) Evaluate bacteria, metals, and other inorganic contaminants in on- and off-reservation household drinking water systems.

The study area for the screening project includes a drainage pathway from a former dump site, an intertidal recreational swimming hole, intertidal areas where shellfish are collected as food, oyster beds recently treated with carbaryl, estuarine reference areas in Willapa Bay, a drainage pathway from cranberry bogs, and household drinking water on- and off-reservation and Grays Harbor.

The DQOs of the preliminary field screening study were to collect documented, representative samples using a minimum number of resource-intensive QA oversight samples. Transfer blanks were collected for cation, anion, nutrient, and microbiological measurements of drinking water samples. Trip blanks were collected for volatile organics compound (VOC) measurements. A pair of blind field duplicate drinking water samples were collected for the measurement of metals, cations, anions, and nutrients in drinking water samples (see Appendix E, Table E-21). The average percent difference (precision) of the two blind field duplicate drinking water samples for 26 metals was 2 %. Five project samples were measured in duplicate by the laboratory for metals, cations, anions, and nutrients (see Appendix E, Tables E-22 to E-24). In addition, the QAPPs required that the laboratory meet the QA and QC requirements which are specified in each analytical method.

Finally, QAPP objectives required that all project data be validated using EPA data quality assessment guidelines to determine if each measurement met the QA and QC requirements of both the QAPPs and the analytical method. The result of this data validation process was the assignment of data qualifiers to selected project measurement values. Tables 5-17 show

measurement results for target compounds which were reported to be above the lower quantitation limit of the sample. Tables C-1 to C-6 in Appendix C show the list of target compounds which were not measured in samples above the lower quantitation limit of the sample.

The major use of the data for this limited, screening study, is to provide a basis for the determination of a need of future environmental investigations, and to assist in the design of such investigations.

5.2 QA/QC Samples

Specific transfer blanks, trip blanks, and field duplicates were collected in order to demonstrate the integrity and precision of specific project samples.

Project DQOs required that all quality control (QC) requirements for the measurement of all project samples meet the stated QC specifications of each analytical method. These analytical methods required that the laboratory measure method blanks, matrix spike (MS) samples (inorganics), matrix spike/matrix spike duplicate (MS/MSD) samples (organics), and sterility controls on transport/transfer blanks, dilution water blanks, media agar and broth blanks, and positive and negative control samples for microbiological measurements to ensure that results were within QC limits for each method. The laboratory also demonstrated laboratory precision by measuring duplicates of project samples.

All QA and QC data from the measurement of both field and laboratory samples were used in assessing the quality of project data (see Appendixes D and E). Any project data which did not meet the stated requirements of the QAPPs or analytical method was qualified with appropriate data quality flags (see Appendixes F and G).

For organics data in this Report, the associated numerical value next to a "U" or "UJ" qualifier is the sample quantitation limit (SQL), which is based upon the lowest calibration point of the 5-point initial calibration curve and any dilutions which were made to the sample due to high concentrations or matrix effects. For metals and inorganic data in this Report, the associated numerical value next to a "U" or "UJ" qualifier is the method detection limit (MDL) for the sample, which is defined in 40 CFR Part 136, Appendix B.

5.3 Validation of Project Data

Project data were validated by the EPA Region 10 Laboratory. National EPA data validation guidelines were used to determine the quality of organics data (19),(20) and inorganics data (21),(22).

5.4 Results from the Validation of Project Data

Using the objectives and criteria stated in the QAPPs and the data validation guidelines in Section 5.2 and 5.3, above, project data were validated by the EPA Region 10 Manchester Laboratory. Validation results are documented in the Reference section of this report.

Table 5. Inorganics Measurements of Dump Site Samples

Station Number	CAS Number	1	2	3	4	5
Location		Dump Site	Dump Site, Leachate	FW Stream, Below Dump Site	FW Stream, Below Dump Site	Estuary, Upper Beach Lagoon
EPA Sample Number		95080025	95080026	95080023	95080024	95080021
Media		Sediment	Water	Sediment	Water	Sediment
Metals Measurements						
Units		mg/kg		µg/l		mg/kg
Aluminum	7429905	4710		36.9	BN	10600
Arsenic	7440382	5.76	E	1	U	6.8
Barium	7440393	411		195		15.4
Beryllium	7440417	0.75	P	0.3	U	0.42
Cadmium	7440439	6.6	P	0.52	P	0.23
Calcium	7440702	10100		101000		2880
Chromium	7440473	5.9	P	1	U	19.1
Copper	7440508	59.7		2	P	15.9
Iron	7439896	386000		8010		25700
Lead	7439921	142		1.93	B	13.5
Magnesium	7439954	1070		12700		4450
Manganese	7439965	444		141		133
Mercury	7439976	0.0211		0.1	U	0.0155
Nickel	7440020	106		13		11.7
Potassium	7440097	450	U	8950		1030
Sodium	7440235	226		25800		7300
Zinc	7440666			237		59.5
General Chemistry Measurements:						
Units				mg/l		mg/l
Alkalinity				263		18.8
Ammonia				0.052	J	0.02
Chloride				41.9		27.7
Fluoride				0.067		0.05
Nitrate+Nitrite				1.22		1.15
Sulfate				51.4		11.6

Table 6. Organics Measurements of Dump Site Samples

Station Number	CAS Number	1		2		3		4		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080024		95080021	
Media		Sediment		Water		Sediment		Water		Sediment	
Units		µg/kg		µg/l		µg/kg		µg/l		µg/kg	
3-OH-Carbofuran	16655826	4.668	U	0.5	U	10.337	U	0.5	U	18.1	
4-Hydroxy-3,5-dibromobenzoic acid		19	NJ			9	NJ			234	J
4-Hydroxy-3,5-diiodobenzoic acid		127	U			61	NJ			70	J
4-Methylphenol	106445	51.3	J	0.28	U	66.6	U	0.28	U	175	
4-Nitrophenol	100027	212	U	0.257	R	102	U	0.273	R	225	U
Acenaphthene	83329	152	U	0.017	J	66.6	U	0.28	U	103	U
Acifluorfen	50594666	523	R	0.632	R	252	R	0.671	R	554	R
Anthracene	120127	47.1	J	0.28	U	66.6	U	0.28	U	103	U
Benzene	71432	3.2	U	0.081	J	2	U	0.068	J	5.3	U
Benzoic acid, 3-amino-2,5-dichloro-	133904	126	R	0.153	R	61	R	0.163	R	134	R
1,4,5,6,7,7-hexachloro-bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylic acid, (Chlorendic acid)	115286			0.49	J			0.56	J		
Carbofuran	1563662	4.668	U	0.5	U	2.067	U	0.5	U	7.2	
Chloroform	67663	2.2	J	1	U	2	U	1	U	1	J
Di-n-Butylphthalate	84742	5480	U	0.075	J	1630	U	0.28	U	1820	U
Dibenzofuran	132649	43.6	J	0.0087	J	66.6	U	0.28	U	103	U
Diethylphthalate	84662	152	U	0.28	U	66.6	U	0.28	J	103	U
Dinoseb	88857	192	R	0.232	R	92	R	0.246	R	203	R
Endosulfan Sulfate	1031078	57	U	0.05	U	22	J	0.05	U	39	U
Endrin Ketone	53494705	57		0.05	U	25	UJ	0.05	U	39	UJ
Fluoranthene	206440	227		0.01	J	66.6	U	0.28	U	57.3	J
Fluorene	86737	42.2	J	0.28	U	66.6	U	0.28	U	103	U
Mercaptodimethur	2032657	9.336	U	1	U	22.949	U	1	U	21.9	
P,P'-DDD	72548	132	J	0.05	U	25	U	0.05	U	10	J
P,P'-DDE	50293	35	J	0.05	U	9	J	0.05	U	16	J
P,P'-DDT	72559	32	J	0.05	U	25	U	0.05	U	39	UJ
Pentachlorophenol	87865	64	U	0.022	J	31	U	0.024	J	68	U
Pyrene	129000	255		0.28	U	66.6	U	0.28	U	103	U
Retene	483658	152	U	0.28	U	332		0.28	U	51.1	J
Toxaphene	8001352	1142	U	0.82	J	166	U	1.07	U	772	U

Table 7. Tentatively identified organics in dumpsite samples. (Page 1 of 2)

Station Number	CAS Number	1		2		3		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080021	
Media		Sediment		Water		Sediment		Sediment	
Units		ug/Kg		ug/L		ug/Kg		ug/Kg	
Semivolatile (BNA) Target Compounds									
.gamma.-Sitosterol	83476							5460	NJ
1-Phenanthrenecarboxylic	1740198							693	NJ
11-Hexadecenoic acid, methyl ester	55000425							1860	NJ
9,12-Octadecadienoic acid (Z,Z)-	60333					454	NJ		
9-Hexadecenoic acid	57103	11900	NJ			4130	NJ	8150	NJ
9-Hexadecenoic acid, methyl ester, (Z)-	1120258	2440	NJ						
Aromatic Unknown 01		5190	JN	0.23	NJ	2020	JN	4700	JN
Benzaldehyde, 4-hydroxy-	123080	664	NJ						
Benzaldehyde, 4-hydroxy-	121335	406	NJ			540	NJ		
Carbamic acid, phenyl-, 1-methylethyl es	122429			0.19	NJ				
Cholesterol	57885	504	NJ			307	NJ	1070	NJ
Docosanoic acid	112856	800	NJ			766	NJ	1390	NJ
Docosanoic acid, methyl	929771	301	NJ						
Dodecanoic acid	143077					762	NJ		
Eicosanoic acid	506309	670	NJ			389	NJ	752	NJ
Hexadecanoic acid	57103	22400	NJ			11500	NJ	19200	NJ
Hydrocarbon Unknown 03				0.21	NJ				
Hydrocarbon Unknown 02				0.18	NJ				
Hydrocarbon Unknown 01		3630	JN	0.24	NJ				
Lup-20(29)-en-3-one	1617705	8390	NJ			3460	NJ		
Oxacycloheptadecan-2-one	109295	3100	NJ			1050	NJ	2460	NJ
Pentadecanoic acid, 14-methyl, methyl e	5129602	3250	NJ			1070	NJ	2410	NJ
Pentadecanoic acid	1002842	1840	NJ			2030	NJ	4680	NJ
Pentadecanoic acid, methyl ester	7132641					307	NJ		
Phytol	150867	4330	NJ			1110	NJ	7250	NJ
Stigmast-4-en-3-one	1058613	1750	NJ			980	NJ	1890	NJ
Tetradecanoic acid, 12-m	5746587	2480	NJ			1140	NJ	5660	NJ
Tetradecanoic acid	544638	2140	NJ			915	NJ	3560	NJ
Tetradecanoic acid, 12-m	5129668							563	NJ
Tetradecanoic acid, 12-methyl ester, (S)-	62691058	504	NJ						
Unknown 05		645	JN			1590	JN		
Unknown 06		7360	JN						
Unknown 08		2030	JN						
Unknown 04		1610	JN			391	JN	1380	JN
Unknown 03						398	JN	879	JN
Unknown 02				0.34	NJ			4260	JN
Vitamin E	59029	275	NJ			179	NJ	304	NJ

Table 7. Tentatively identified organics in dumpsite samples, continued (Page 2 of 2)

Station Number	CAS Number	1		2		3		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080021	
Media		Sediment		Water		Sediment		Sediment	
Units		ug/Kg		ug/L		ug/Kg		ug/Kg	
Volatile Target Compounds									
1,2-Propadiene	463490					4.7	NJ		
1,2,4-Trioxolane, 3,5-diphenyl-	23888155							7.4	NJ
2-Heptanone	110430							4	NJ
2-Hexene, 5-methyl-, (E)	7385822					6.2	NJ		
2,5-Cyclohexadien-1-one, 4-ethyl-3,4-dim	17429355							5.7	NJ
2-Butene, (E)	624646	3.9	NJ						
2-Decene, 4-methyl-, (Z)-	74630301	6.6	NJ						
4-Undecene, (E)	693629	5.4	NJ						
4-Nonene, 3-methyl-, (Z)	63830693	9.9	NJ						
Cyclohexane, 1,1,2,3-tetramethyl	6783922	21.2	NJ						
Cyclohexane, 2,4-diethyl-1-methyl-	61142709	6.1	NJ						
Cyclopentane, 1,2-dibutyl-	62199524	8.2	NJ						
Decanal	112312							6.4	NJ
Decane, 2,2,6-trimethyl-	62237972	9.8	NJ						
Disulfide, dimethyl	624920					3.2	NJ		
Ethyne, dichloro-	7572294	3.6	NJ						
Hexanal	66251							4.5	NJ
Methane, thiobis-	75183	4.4	NJ			7.9	NJ	20.4	NJ
Nonane, 3-methyl-5-propyl-	31081182	11.8	NJ						
Octane	111659					4.6	NJ		
Pentane	109660					7.1	NJ		

Table 8. Microbiology Measurements of Dumpsite Samples

Station Number	15	16A	16B	Transfer Blank
Location	Dump Site Leachate	FW Stream, Above Dump Site	FW Stream, Below Dump Site	
Media	Water	Water	Water	Water
EPA Sample Number	95080031	95080032	95080030	
Total coliform #/100 ml	20	130	7.8	< 1.8
Fecal coliform #/100 ml	< 18	4.5	2.0	< 1.8
<i>E. coli</i> #/100 ml	< 18	2.0	2.0	< 1.8
<i>Enterococci</i> #/100 ml	< 18	4.0	2.0	< 1.8
HPC #/ml	2,500 ²	10,000 ¹	1,800 ²	< 1.0
SPS Anaerobic #/ml	clear = 6.6 black = 0.5 total = 7.1	19.8	< 1	< 1
SPS Aerobic #/ml	21	22.3	5.6	< 1
Ratio Anaerobic/Aerobic	2.96	1.13	< 5.6	-
<i>Clostridium perfringens</i> #/ml	0.5 no enterotoxin present	< 1	< 1	< 1

¹Yellow colonies present.

²Yellow and Purple colonies present.

Table 9. Inorganics Measurements of Cranberry Bog Samples

Station Number	CAS Number	6	7	8	9				
Location		Upper Cranberry Ditch	Upper Cranberry Ditch	Lower Cranberry Ditch	Lower Cranberry Ditch				
Media		Sediment	Water	Sediment	Water				
EPA Sample Numbers		95240100 95240101	95240103 95240105 95240104 95240102	95240106 95240107	95240111 95240110 95240109 95240108				
Metals Measurements									
Units		mg/kg		µg/l		mg/kg		µg/l	
Aluminum	7429905	6050		67	P	6080		71	P
Arsenic	7440382	10	U	6.42	N	10	U	7.82	N
Barium	7440393	14.4		3.4	P	9.41		2.5	P
Beryllium	7440417	0.229		0.3	U	0.17	P	0.3	U
Calcium	7440702	1660		7270		1340		12900	
Chromium	7440473	11.2		1	U	11.4		1	U
Cobalt	7440484	3.94		10	U	2.92		10	U
Copper	7440508	5.25		3	U	2.7		3	U
Iron	7439896	20300		4710		15000		4840	
Lead	7439921	3.7	P	0.5	U	1.7	P	0.5	U
Magnesium	7439954	3090		5510		2990		22900	
Manganese	7439965	130		104		101		110	
Nickel	7440020	8.57		0.3	U	10.7		0.3	U
Potassium	7440097	358		3610		379		8340	
Selenium	7782492	10	P	2	U	6.4	P	2	U
Silver	7440224	0.44	P	0.1	UNE	0.3	P	0.1	UNE
Sodium	7440235	132		24600		259		167000	
Vanadium	7440622	27.4		3.3	P	22.7		3	U
Zinc	7440666	35.3		7	PB	24.9		11	PB
%Solid (Metals)		63.5%				71.2%			
General Chemistry Measurements									
Units		mg/kg		mg/l		mg/kg		mg/l	
Alkalinity				53.4				54.3	
Chloride				26.7				269	
Fluoride				0.242				0.16	
Kjel-Nitrogen				0.762	J			0.371	J
Ammonia				0.078				0.074	
Nitrate/Nitrite				0.174				0.085	
Total Phosphorus				0.324				0.245	
Sulfate				4.45				40.1	

Table 10. Organics Measurements of Cranberry Bog Samples

Station Number	CAS Number	6		7		8		9	
Location		Upper Cranberry Ditch		Upper Cranberry Ditch		Lower Cranberry Ditch		Lower Cranberry Ditch	
Media		Sediment		Water		Sediment		Water	
EPA Sample Numbers		95240100 95240101		95240103 95240105 95240104 95240102		95240106 95240107		95240111 95240110 95240109 95240108	
Units		µg/kg		µg/l		µg/kg		µg/l	
2,4-D	94757	51	UJ	0.12		42	UJ	0.091	
Azinphos-methyl	86500	36	UJ	0.21		28	U	0.22	
Carbofuran	1194656			0.43	NJ			0.35	NJ
Chlorpropham (CIPC)	101213	91	U	0.1	J	70	U	0.1	J
Chlorpyrifos	2921882	16	U	0.044	J	12	U	0.046	J
Diazinon	333415	18	U	0.23		14	U	0.27	
Dichlobenil	1194656	10	NJ	1.9		1.5	NJ	2	
Dichlorobenzamide				0.14	NJ			0.14	NJ
Napropamide	15299997	68	U	0.2		52	U	0.2	
Norflurazon	273141132	18	U	1		35	U	0.78	
o,p'-DDD	53190	18	NJ	0.048	U	10	UJ	0.048	U
p,p'-DDT	50293	4.5	NJ	0.12	U	10	UJ	0.11	U
p,p'-DDD	72548	71	NJ	0.0088	J	3	NJ	0.01	J
p,p'-DDE	72559	30	NJ	0.048	U	10	U	0.048	U
Trichlopyr	55335063	41	UJ	0.028	J	34	UJ	0.023	J

Table 11. Metals Measurements of Tideflat Samples

Station Number	CAS Number	10		11		12		12A		13		14		23	
Location		Willapa Bay, Oyster Bed		Willapa Bay, Oyster Bed		SBIR, Swimming Hole, 1994		SBIR, Swimming Hole, 1995		Hawks Point Shellfish Area		Willapa Bay Ellen Sands		Grays Harbor, South Bay	
EPA Sample Number		94344301		94344302		94344303		95080022		9434304		9434300		95080020	
Media		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Units		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Aluminum	55000425	10300		5710		10700		9720		6590		5620		15100	
Antimony	7440360	4	U	4	U	4	U	5.5	PBN	4	U	4	U	4	UN
Arsenic	7440382	4.98		3.97		8.94		9.46		2.71		2.99		14.4	
Barium	7440393	15.8		5.57		17		17.6		6.01		6.08		23.3	
Beryllium	7440417	0.37	P	0.19	P	0.38	P	0.542		0.24	P	0.19	P	0.808	
Calcium	7440702	2510		1410		2650		2390		1470		1600		3850	
Chromium	7440473	18.3		12.6		19.9		18.9		12.7		11.1		30.4	
Copper	7440508	10.4		3.9		12.5		15.3		4.77		3.84		28.4	
Iron	7439896	19600		13700		27800		18500		13000		12900		36100	
Lead	7439921	3.58		2.22		4.5		8.33		1.71		1.8		13.7	
Magnesium	7439954	5270		3420		5270		4950		3420		3170		7380	
Manganese	7439965	136		128		134		114		111		141		145	
Mercury	7439976	0.05	U	0.05	U	0.05	U	0.0222		0.05	U	0.05	U	0.0445	
Nickel	7440020	13		8.56		13.2		14.4		9		8.87		19.6	
Potassium	7440097	1930		866		1970		1830		796		730		2680	
Sodium	7440235	6730		3270		5080		2480		2940		2910		13300	

Table 12. Organics Measurements of Tideflat Samples

Station Number	CAS Number	10		11		12		12A		13		14		23	
Location		Willapa Bay, Oyster Bed		Willapa Bay, Oyster Bed		SBIR, Swimming Hole, 1994		SBIR, Swimming Hole, 1995		Hawks Point Shellfish Area		Willapa Bay Ellen Sands		Grays Harbor, South Bay	
EPA Sample Number		94344301		94344302		94344303		95080022		9434304		9434300		95080020	
Media		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Units		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg	
1,3,5-Trimethylbenzene										2.2	U	0.02	J		
1H-Indole, dibromo		35	J												
2-Hexanone	591786	3.4	J	1.8	U	4	U	11.6	UJ	2.2	U	2.8	U	11.1	UJ
4-Hydroxy-3,5-dibromobenzoic acid								119	J					231	J
4-Hydroxy-3,5-dibromobenzonitrile	1689845	134	J	66	J	205	J	73	U	10	J	37	J	140	U
4-Hydroxy-3,5-diiodobenzoic acid								172	J					167	J
4-Hydroxy-3,5-diiodobenzonitrile	1689834	217	J	99	J	261	J	76	UJ	44	J	128	J	144	UJ
4-Methylphenol	106445	131	U	108	U	152	U	205						54.6	J
4-Methyl-2-pentanone	108101	0.95	J	1.8	U	4	U	2.3	U	2.2	U	1.4	U	2.2	UJ
Acifluorfen	50594666	273	U	249	U	310	U	297	R	248	U	227	U	567	R
Benzoic acid, 3-amino-2,5-dichloro-	133904	66	U	60	U	75	U	72	R	60	U	55	U	137	R
Butyltin trichloride	1118463	6.4	J	3.5	U	5.3	U	10.7	U	4.1	U	4.6	U	7.5	U
Carbon disulfide	75150	4	U	9	U	19.8	J	3.3	U	2.7	U	7	U	4	U
Chloroform	67663	3.5	U	1.8	U	4	U	1.1	J	2.2	U	2	U	0.6	J
Dibutyltin dichloride	683181	8.7	U	7	U	21.6		10.8	U	8.4	U	9.3	U	7.6	U
Dichlorobenzoic Acid		65	R	60	R	74	R			59	R	55	R		
Dinoseb	88857	100	R	91	R	114	R	109	R	91	R	83	R	208	R
Ethylbenzene	100414	3.5	U	1.8	U	4	J	2.3	U	2.2	U	1.4	U	2.2	U
Fluoranthene	206440	131	U	108	U	152	UJ	68.2	U	116	U	94	U	44.1	J
Hexachlorobenzene	118741					10.3	J			116	U	94	U		
Pyrene	129000	17.2	J	108	U	152	UJ	68.2	U	116	U	94	U	125	U
Retene	483658	131	U	108	U	152	UJ	31.8	J	116	U	94	U	125	U
Tributyltin chloride	1461229	8.8		3.8	U	1.4	J	11.6	U	4.5	U	5	U	8.1	U

Table 13. Tentatively Identified Organics Measurements of Tideflat Samples (Page 1 of 2)

Station Number	CAS Number	10		11		12		12A		13		14		23	
Location		Willapa Bay, Oyster Bed		Willapa Bay, Oyster Bed		SBIR, Swimming Hole, 1994		SBIR, Swimming Hole, 1995		Hawks Point Shellfish Area		Willapa Bay Ellen Sands		Grays Harbor, South Bay	
EPA Sample Number		94344301		94344302		94344303		95080022		9434304		9434300		95080020	
Media		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Units		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
.gamma.-Sitosterol	83476	1720	NJ			3.2	NJ	5240	NJ						
11-Hexadecenoic acid, methyl ester	55000425													1790	NJ
16-Octadecenoic acid, methyl ester	56554495													1050	NJ
2-Hexanone, 4-methyl	105420							1.3	NJ						
9-Hexadecenoic acid	2091294	1370	NJ					2600	NJ	804	NJ			7260	NJ
Aldol Condensate Unknown								733	JN						
Cholesterol	57885							3730	NJ					2760	NJ
Docosanoic acid	112856							754	NJ					820	NJ
Eicosanoic acid	506309							362	NJ					327	NJ
Hexanedioic acid, bis(2-ethylhexyl) ester	103231									237	NJ				
Hexadecanoic acid, methyl ester	112390							816	NJ						
Hexadecanoic acid	57103							7320	NJ					19900	NJ
Hexanal	66251							1.4	NJ					1.2	NJ
Hydrocarbon Unknown 02		788	J			714	NJ	1430	JN						
Hydrocarbon Unknown 03		400	NJ					2740	JN						
Hydrocarbon Unknown 04														1270	JN
Hydrocarbon Unknown 01		663	NJ	66.1	NJ	396	NJ	1240	JN					1800	JN

Table 13. Tentatively Identified Organics Measurements of Tideflat Samples, continued (Page 2 of 2)

Station Number	CAS Number	10		11		12		12A		13		14		23	
Location		Willapa Bay, Oyster Bed		Willapa Bay, Oyster Bed		SBIR, Swimming Hole, 1994		SBIR, Swimming Hole, 1995		Hawks Point Shellfish Area		Willapa Bay Ellen Sands		Grays Harbor, South Bay	
EPA Sample Number		94344301		94344302		94344303		95080022		9434304		9434300		95080020	
Media		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Units		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Oxacycloheptadecan-2-one														1400	NJ
Oxacyclotetradecan-2-one								583	NJ						
Pentadecanoic acid, 14-methyl, methyl ester	109295			71.5	NJ									2480	NJ
Pentadecanoic acid			NJ					1100	NJ					2590	NJ
Phytol	1725048							1100	NJ					5250	NJ
Propanal, 2-methyl-	78842							1.3	NJ						
S6						513	J					139	NJ		
S7						882	NJ			352	NJ				
Stigmast-4-en-3-one	1058613							1780	NJ					2220	NJ
Sulfur, mol. (S8)	10544500	876	NJ	301	NJ	57.2	NJ	738	NJ	2700	NJ	1320	NJ	2820	NJ
Tetradecanoic acid, 12-m	5129668							351	NJ					738	NJ
Tetradecanoic acid, 12-m	5746587							1520	NJ					4770	NJ
Tetradecanoic acid	544638							562	NJ					1470	NJ
Thiobismethane	75183							3.3	NJ					4.1	NJ
Unknown 02		677	J	76.5	J	435	J	1710	JN	252	J	57.5	J	494	JN
Unknown 03		821	J			686	J	1070	JN	350	J	123	J	1610	JN
Unknown 04						405	J	1150	JN	616	J			1840	JN
Unknown 05						245	J	1250							
Unknown 06						278	J								
Unknown 01		14	NJ	73.9	J	329	J	2610	JN	1700	J	109	J	4830	JN
Vitamin E	59029							444	NJ					673	NJ

Table 14. Lead Measurements in Drinking Water Samples

Station Number	EPA Sample Number	Sample Descriptor	Lead "First Pour" (µg/l)		Lead "Flushed Tap" (µg/l)		Temperature (°C)	pH	Conductivity (µS)
1	95430559	Reservation-east	0.5	U			22.8	7.46	171
3	95430557	Reservation-east	0.69	P			21.9	7.95	173
4	95430539	Reservation-east	0.77	P			12	7.61	171
5	95430561	Reservation-east	0.74				23.3	7.55	172
6	95430534	Reservation-east	0.5	U			13	7.57	170
7	95430537	Reservation-east	0.91	P			15	7.32	170
8	95430550	Reservation-east	0.76	P	0.5	U	20	7.13	173
9	95430545	Reservation-east	0.5	U	0.5	U	11	7.34	171
10	95430530	Reservation-east	3.64				13	7.7	184
12	95430531	Reservation-east	0.58	P			14	7.83	164
14	95430532	Reservation-east	0.68	P			14	7.66	170
15	95430536	Reservation-east	0.73	P			13	7.3	171
16	95430556	Reservation-east	0.5	U			22.3	7.57	173
17	95430549	Reservation-east	0.81	P			9	7.37	171
18	95430560	Reservation-east	0.56	P			23.3	7.55	172
19	95430538	Reservation-east	1.27		0.5	U	13	7.64	172
20	95430540	Reservation-east	0.65	P			13	7.29	170
24	95430546	Reservation-center	0.5	U			13	7.26	170
25	95430548	Reservation-west	6.28				14	7.38	169
26	95430547	Reservation-west	2.54				12	7.38	170
28	95430558	Reservation-west	4.23				21.5	7.79	166
31	95430552	Reservation-west	0.58	P	0.5	U	18	7.35	171
33	95430533	Westport	3.22				13	8.09	362
34	95430535	Grayland	0.5	U	0.5	U	12	7.48	183
38	95430551	Reservation-annex	1.56		0.5	U	16	7.46	211
39	95430542	Reservation-annex	0.5	U	0.5	U	15	7.28	211
40	95430543	Ocosta	0.5	U	0.5	U	12	7.48	130
41	95430554	Ocosta	1.59		0.5	U	17	7.62	175
42	95430555	Ocosta	0.5	U	0.5	U	17	7.27	238
44	95430544	South Bend	3.32		0.55		11	6.89	93
46	95430553	Reservation-east	3.37		0.88		16	7.18	194
47	95430541	Westport	0.5	U	0.5	U	19	7.72	364

Table 15. Metals Measurements of Drinking Water Samples (Page 1 of 2)

STATION	CAS NUMBER	METHOD NUMBER	8		9		19		31		34		35		35		36		37		38		39		
LOCATION			Reservation east		Reservation east		Reservation east		Reservation west		Grayland		Reservation Dexter		Reservation Dexter		Reservation Dexter		Reservation east		Reservation Annex		Reservation Annex		
EPA NUMBER			95430508		95430501		95430503		95430502		95430520		95430516		95430517		95430500		95430507		95430504		95430505		
SOURCE			kitchen tap		kitchen tap		kitchen tap		kitchen tap		laundry tap		outdoor tap		outdoor tap		kitchen tap		kitchen tap		kitchen tap		kitchen tap		
UNITS			µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		
Aluminum	7429905	ICP/SAS	200.7	24	P	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Antimony	7440360	ICP/MS	200.8	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Arsenic	7440382	ICP/MS	200.8	1.7	P	1.7	P	1.5	P	1.6	P	2.6	P	5.3		5.28		5.05		1.8	P	4.2	P	4.2	P
Barium	7440393	ICP/SAS	200.7	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Beryllium	7440417	ICP/SAS	200.7	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Boron	7440428	ICP/SAS	200.7	24	P	17	P	16	P	21	P	27	P	16	P	17	P	19	P	19	P	23	P	21	P
Cadmium	7440439	ICP/SAS	200.7	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Calcium	7440702	ICP/SAS	200.7	12400		12500		12300		12400		15300		16100		16100		16700		12500		23900		23900	
Chromium	7440473	ICP/SAS	200.7	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cobalt	7440484	ICP/SAS	200.7	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Copper	7440508	ICP/MS	200.8	15.2		6.7		65.4		8.88		3.4	P	1.3	P	1.3	P	1.4	P	38.2		2.2	P	1	U
Iron	7439896	ICP/SAS	200.7	14	P	10	U	21.5		17	P	10	U	10	U	10	U	11	P	12	P	170		186	
Lead	7439921	ICP/MS	200.8	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Magnesium	7439954	ICP/SAS	200.7	5400		5380		5390		5340		7000		5590		5560		5290		5400		4730		4740	
Manganese	7439965	ICP/SAS	200.7	1	U	1	U	1	U	1	U	1	U	1.1	P	1	U	1	U	1	U	114		138	
Mercury	7439976	CVAA	200.8	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Molybdenum	7439987	ICP/SAS	200.7	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Nickel	7440020	ICP/SAS	200.7	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Potassium	7440097	ICP/SAS	200.7	1600	P	1500	P	1200	P	1600	P	1300	P	1900	P	2000		1800	P	1500	P	3120		3130	
Selenium	7782492	ICP/MS	200.8	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Silica	7631869	ICP/SAS	200.7	32600		33200		32800		32800		23300		25200		25100		25400		32800		36000		36100	
Silver	7440224	ICP/SAS	200.7	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Sodium	7440235	ICP/SAS	200.7	14400		14500		14700		13900		11700		9800		9740		9760		14300		11500		11600	
Thallium	7440280	ICP/MS	200.8	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	7440622	ICP/SAS	200.7	16.5		15.7		14.4		15.3		10.1		8.3	P	8	P	9.1	P	16.2		3	U	3	U
Zinc	7440666	ICP/SAS	200.7	48.3		31.7		36.7		61.3		5.5	P	7.7	P	9.6	P	26.2		40.9		6.7	P	4.2	P

Table 15. Inorganic Measurements in Drinking Water Samples (Continued, Page 2 of 2)

STATION	CAS NUMBER	METHOD NUMBER	40		41		42		44		45		46		47		48		49		50		BLANK		
LOCATION			Ocosta		Ocosta		Ocosta		South Bend		Bay Center		Reservation east		Westport		Reservation center		Tokeland		Reservation Tokeland				
EPA NUMBER			95430509		95430510		95430511		95430514		95430515		95430518		95430512		95430506		95430513		95430519		95430521		
SOURCE			kitchen tap		kitchen tap		bathroom tap		kitchen tap		bathroom		kitchen tap		kitchen tap		well tap		kitchen tap		well tap		blank		
UNITS			µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		
Aluminum	7429905	ICP/SAS	200.7	20	U	20	U	20	U	30	P	20	U	20	U	20	U	20	P	20	U	20	U	20	U
Antimony	7440360	ICP/MS	200.8	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Arsenic	7440382	ICP/MS	200.8	1	U	2.8	P	4.2	P	1	U	1.1	U	1.7	P	10.5		1	U	5.9		1.2	P	1	U
Barium	7440393	ICP/SAS	200.7	2	U	3.4	P	3.5	P	2	U	11.6		2	U	2	U	2	U	2	U	2.9	P	2	U
Beryllium	7440417	ICP/SAS	200.7	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Boron	7440428	ICP/SAS	200.7	19	P	21	P	23	P	17	P	46	P	18	P	130		24	P	16	P	47	P	19	P
Cadmium	7440439	ICP/SAS	200.7	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Calcium	7440702	ICP/SAS	200.7	12500		16000		18600		7720		38100		12400		7150		9520		15600		13000		5	U
Chromium	7440473	ICP/SAS	200.7	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cobalt	7440484	ICP/SAS	200.7	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Copper	7440508	ICP/MS	200.8	1.6	P	1	U	1	U	46		1	U	40.5		3.6	P	1	U	6.21		1	U	1	U
Iron	7439896	ICP/SAS	200.7	17	P	1140		1090		25.8		1160		16	P	40.8		4930		39.7		334		10	U
Lead	7439921	ICP/MS	200.8	0.5	U	0.5	U	0.5	U	0.55	P	0.5	U	0.88	P	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Magnesium	7439954	ICP/SAS	200.7	4430		7910		12500		2410		14700		5360		14100		4320		5860		7630		20	U
Manganese	7439965	ICP/SAS	200.7	1	U	266		414		1	U	165		1	U	4.7	P	19.3		18.4		94		1	U
Mercury	7439976	CVAA	200.8	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Molybdenum	7439987	ICP/SAS	200.7	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Nickel	7440020	ICP/SAS	200.7	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Potassium	7440097	ICP/SAS	200.7	1000	P	3340		4650		820	P	8440		1500	P	13600		1600	P	1800	P	1700	P	650	U
Selenium	7782492	ICP/MS	200.8	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Silica	7631869	ICP/SAS	200.7	22400		41600		62800		19500		49100		32400		22400		12100		26100		30400		64	U
Silver	7440224	ICP/SAS	200.7	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Sodium	7440235	ICP/SAS	200.7	7870		7880		11300		7360		9810		14500		40100		12600		9740		58000		39	P
Thallium	7440280	ICP/MS	200.8	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	7440622	ICP/SAS	200.7	3	U	3	U	9.4	P	3	U	3	U	15		3	U	4.9	P	7.1	P	3	U	3	U
Zinc	7440666	ICP/SAS	200.7	83.2		21		9.8	P	4	U	4.1	P	140		4	U	1050		4	U	4	U	4	U

Table 16. General Chemistry Measurements of Drinking Water Samples

STATION	METHOD NUMBER	8		9		19		31		34		35		35		36		37		38		39		
LOCATION		Reservation east		Reservation east		Reservation east		Reservation west		Grayland		Reservation Dexter		Reservation Dexter		Reservation Dexter		Reservation east		Reservation Annex		Reservation Annex		
EPA NUMBER		95430508		95430501		95430503		95430502		95430520		95430516		95430517		95430500		95430507		95430504		95430505		
SOURCE		kitchen tap		kitchen tap		kitchen tap		kitchen tap		laundry tap		outdoor tap		outdoor tap		kitchen tap		kitchen tap		kitchen tap		kitchen tap		
UNITS			mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l	
Alkalinity	Titrimetry	310.1	54.5		54.2		71.9		53.4		36		73.1		60		60.6		54.4		76.2		93.6	
Chloride	Ion Chrom.	300.0	16.5		16.5		16.4		16.1		16.8		11.6		11.6		11.6		16.4		13.1		13.1	
Fluoride	Ion Chrom.	300.0	0.963		0.984		0.952		0.847		0.155		0.192		0.193		0.192		0.846		0.235		0.24	
Ammonia, N	Colorimetry	350.1	0.21	HJN	0.18	HJN	0.29	HJN	0.23	HJN	0.12	HJN	0.2	HJN	0.16	HJN	0.23	HJN	0.16	HJN	0.19	HJN	0.21	HJN
Nitrate+Nitrite,N	Colorimetry	353.2	0.076		0.079		0.074		0.074		0.17		0.036		0.04		0.037		0.085		0.007	U	0.008	
Tot Phosphorus	Colorimetry	365.1	0.202		0.257		0.24		0.203		0.121		0.244		0.208		0.19		0.211		0.52		0.53	
Sulfate	Ion Chrom.	300.0	3.03		3.1		3.02		3.02		5.43		5.06		5.07		5.13		3		7.85		8.27	
Temperature	Electrometry		16.6		13.5		14.4		14.2		12.1		13.2		13.2		13.5		15.1		13.2		13.7	
pH, field	Electrometry		7.74		7.92		7.78		7.76		8.62		8.69		8.69		8.44		7.75		7.81		7.81	
Conductivity	Electrometry		174		174		174		170		184		169		169		195		171		214		212	

STATION	METHOD NUMBER	40		41		42		44		45		46		47		48		49		50		BLANK		
LOCATION		Ocosta		Ocosta		Ocosta		South Bend		Bay Center		Reservation east		Westport		Reservation center		Tokeland		Reservation Tokeland				
EPA NUMBER		95430509		95430510		95430511		95430514		95430515		95430518		95430512		95430506		95430513		95430519		95430521		
SOURCE		kitchen tap		kitchen tap		bathroom tap		kitchen tap		bathroom		kitchen tap		kitchen tap		well tap		kitchen tap		well tap		blank		
UNITS			mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l	
Alkalinity	Titrimetry	310.1	36.2		101		106		29.5		164		54.1		110		65.7		200		164		1.31	
Chloride	Ion Chrom.	300.0	6.63		7.77		9.55		7.79		10.8		16.5		36		17		10.8		14.9		0.05	U
Fluoride	Ion Chrom.	300.0	0.169		0.251		0.314		1.01		0.239		0.976		0.311		0.164		0.196		0.398		0.01	U
Ammonia, N	Colorimetry	350.1	0.16	HJN	0.36	HJN	0.12	HJN	0.1	HJN	0.95	HJN	0.22	HJN	0.22	HJN	0.22	HJN	0.24	HJN	0.49	HJN	0.14	HJN
Nitrate+Nitrite,N	Colorimetry	353.2	0.168		0.007	U	0.007	U	0.59		0.007	U	0.081		0.009		0.007	U	0.033		0.007	U	0.007	U
Tot Phosphorus	Colorimetry	365.1	0.081		0.512		1.15		0.045		1.26		0.257		0.512		0.054		0.2		0.82		0.052	
Sulfate	Ion Chrom.	300.0	2.59		2.99		1.72		3.12		1.23		3.04		10.4		1.26		5.94		3.37		0.05	U
Temperature	Electrometry		12.6		13.6		12.7		7.3		13.7		12.6		13.5		11.9		13		12.9			
pH, field	Electrometry		7.59		7.55		7.04		7.68		7.83		8.08		8.03		8.76		7.95		7.83		7.12	lab
Conductivity	Electrometry		130		182		241		99		345		170		364		144		205		359		2	lab

Table 17. Manganese and Iron in Drinking Water Samples

Station Number	EPA Sample Number	Sample Descriptor	Source	Manganese ug/l	Iron ug/l
38	95430504	Reservation-annex	kitchen tap	114	170
39	95430505	Reservation-annex	kitchen tap	138	186
41	95430510	Ocosta	kitchen tap	266	1140
42	95430511	Ocosta	bathroom tap	414	1090
45	95430515	South Bend	bathroom tap	165	1160
46	95430518	Reservation-east	kitchen tap	19.3	4930
47	95430512	Westport	kitchen tap	94	334

Table 18. Microbiology Measurements of Drinking Water Samples

Station Number	Sample Descriptor	EPA Sample Number	Total Chlorine	Free Chlorine	Total Coliform per 100 ml	Repeat sampling and results, proportion and (#/100ml)
1	Reservation-east	95430603	0.25	0.2	< 1	no
2	Reservation-east	95430604	0.25	0.2	< 1	no
3	Reservation-east	95430605	0.2	0.15	< 1	no
4	Reservation-east	95430606	0.25	0.25	< 1	no
5	Reservation-east	95430607	0.2	0.2	< 1	no
6	Reservation-east	95430608	0.25	0.2	< 1	no
7	Reservation-east	95430609	0.25	0.25	< 1	no
8	Reservation-east	95430610	0.25	0.25	< 1	no
9	Reservation-east	95430611	0.3	0.3	< 1	no
10	Reservation-east	95430612	0.25	0.25	< 1	no
12	Reservation-east	95430613	0.3	0.3	< 1	no
14	Reservation-east	95430614	0.2	0.2	< 1	no
15	Reservation-east	95430617	0.3	0.2	< 1	no
16	Reservation-east	95430618	0.3	0.3	< 1	no
17	Reservation-east	95430619	0.3	0.3	< 1	no
19	Reservation-east	95430620	0.3	0.3	< 1	no
20	Reservation-east	95430621	0.35	0.35	< 1	no
21	Reservation-center	95430622	0.3	0.3	< 1	no
24	Reservation-center	95430623	0.3	0.3	< 1	no
25	Reservation-west	95430625	trace	trace	< 1	no
26	Reservation-west	95430626	< 0.1	< 0.1	< 1	no
28	Reservation-west	95430624	trace	< 0.1	< 1	no
31	Reservation-west	95430627	trace	trace	1	yes, 1/4, (2)
32	Westport	95430631	0.15	0.1	< 1	no
33	Westport	95430633	0.1	trace	< 1	no
34	Grayland	95430634	< 0.1	< 0.1	1	yes, 4/4, (1)
35	Reservation-Dexter	95430601	< 0.1	< 0.1	1	yes, 0/4, (< 1)
36	Reservation-Dexter	95430600	< 0.1	< 0.1	3	yes, 1/4,(1)
37	Reservation-east	95430602	0.15	0.1	< 1	no
38	Reservation-annex	95430616	< 0.1	< 0.1	< 1	no
39	Reservation-annex	95430615	< 0.1	< 0.1	< 1	no
40	Ocosta	95430630	< 0.1	< 0.1	< 1	no
41	Ocosta	95430628	< 0.1	< 0.1	< 1	no
42	Ocosta	95430629	< 0.1	< 0.1	1	yes, 1/4, (1)
44	South Bend	95430635	0.7	0.7	< 1	no
47	Westport	95430632	trace	trace	< 1	no
Transfer blank, Day 1		95430636			< 1	yes, (< 1)
Transfer blank, Day 2		95430637			< 1	no

5.4.1 Data Quality Elements Used For Evaluation of Organics Data

Organics data for each sample were evaluated and determined to be acceptable for the following data quality elements except as is noted, below:

- Holding Times and Sample Preservation
- GC/MS Tuning and Performance
- Initial Calibration

Note that a five-point initial calibration was used for all samples except for phenoxy-acid herbicide measurements and the munition compounds measurements, which were from a three-point calibration

- Continuing Calibration
- Blanks (see Appendix D for a listing of method blank results)
- Surrogate Spike Recoveries
- MS/MSD Samples (see Appendix E for a listing of MS/MSD results)

The following target compounds had unacceptable recoveries in MS samples, therefore, results were qualified with an "R" flag: dinoseb in samples 94334300 to 94334304; dinoseb, acifluorfen, chloramben, and 4-nitrophenol in samples 95080020 to 95080026; aniline, hexachloroethane, 4-chloroaniline, and hexachlorocyclopentadiene in sample 95080023; dinoseb, acifluorfen, and chloramben in samples 95080020 to 95080023 and in sample 95080025; dinoseb, acifluorfen, 4-nitrophenol, and chloramben in samples 95080024 and 95080026; and 5-hydroxydicamba, picloram, and dalapon in samples 95240104 and 95240110.

The average recoveries of demeton-o, demeton-s, and disulfoton were 244%, 771%, and 249%, respectfully, in the ms/msd of sample 95080024. These target compounds were qualified with a "UJ" or "J" in samples 95080034 and 95080025.

- Internal Standard Performance
- Target Compound Identification

Two compounds were not measured by the method 8330, used to measure explosives -- RDX and PGDN. RDX and PGDN results are qualified with a "R".

- Tentative Identified Compounds
- Compound Quantitation

- Overall Assessment of Data

5.4.2 Elements Used For Evaluation of Inorganics Data

Inorganics data for each sample was evaluated and determined to be acceptable for the following data quality elements except as is noted, below:

- Holding Time

Holding time for ammonia in some samples were exceeded by one day, and results were qualified with a "H".

- Sample Preparation
- Calibration
- Reference Control Samples
- Blanks
- ICP-AES Interference Check Sample

Ammonia Results Were Qualified with a "J" Due to Unacceptable Results of a QC Check Standard.

- ICP-AES Serial Dilution
- MS Analysis

Recovery of ammonia in sample 95430500 was low and results were qualified with a "N".

- Detection Limits
- Data Summary

5.4.3 Evaluation of Data Validation Reports

Validation results are documented in the Reference Section of this Report (23-47).

The EPA Region 10 QA Unit reviewed each data validation report for completeness and adherence to written EPA data validation guidelines. All project results were determined to have been correctly qualified in the data validation reports and in the sample measurement results.

In cases where more than one qualifier was placed upon the data, the most restrictive qualifier was used to qualify the measurement value.

In general, all project data which do not have an attached qualifier can be used to meet the objectives of the project and the corresponding QAPP. The usefulness of qualified data depends upon the severity of the qualifier, the nature of the sample, and the use of the data. The final usability of the data is determined by the use of the data and the data user.

Chapter 6.0 RESULTS AND DISCUSSION

This limited study, designed to characterize four of the various pollution pathways which could reasonably be considered important to persons living in the area, focused on a relatively few sampling stations. Direct contaminant exposure via air pathways, and possible long term contamination of ground water resources were beyond the scope of the study. Also, with the possible exception of drinking water household sampling, the relatively small number of samples limits the degree of certainty in assessing the likelihood of environmental risk which might be associated with these pollution pathways. However, such an approach does provide an initial focus for screening out major chemical or microbiological problems and highlight issues which may exist in the four contamination routes investigated.

The four basic pollution pathways considered in this assessment were: (See Figure 1)

- (1) **Dump site, and its drainage to tidelands**
(chemical and microbiological screening of sediment and water)
- (2) **Agricultural runoff from cranberry bogs toward tidelands**
(chemical screening for contaminants in sediment and water, focusing especially on pesticides)
- (3) **Tideflat sediments and shellfish associated with nearby Tribal subsistence harvesting and mariculture**
 - (a) sediment screening for chemical contaminants
 - (b) water and shellfish tissue screening for microbiological contaminants from leaking septic systems.
- (4) **Drinking water supplies, at 32 separate households:**
 - (a) tap water screening for lead (32 samples) and other inorganic parameters (11 samples)
 - (b) source water screening for microbiological contaminants from leaking septic systems.

6.1 Dump Site Drainage toward Tidelands (see Tables 5 to 8; Figure 2)

6.1.1 Metals in Dump Site Sediment (Stations #1, 3, 5)

Table 5 shows metal residues and basic water chemistry parameters for the dump site samples. The upper dump site sediment (Station #1) was taken in an area rich in apparent leachate, but surrounded by many discarded, rusting car bodies and other metal waste. Not surprisingly, this sample was very high in iron (nearly 39 %; Table 5). The sediment sample from the lower

part of this waste stream (Station #3) showed only about 2 % iron, with about 2.6 % iron in the sediment from the beach lagoon (Station #5).

Lead was found in the upper sediment at 142 mg/kg (parts per million; ppm), decreasing to 18.1 mg/kg in the lower sediment, and 13.3 mg/kg in the sediment from the lower beach lagoon as the pathway progresses toward the sea. For these samples, lead levels were well below the State of Washington's marine sediment quality standard of 450 ppm (dry weight) (48), and EPA Region 10's risk-based criterion of 400 mg/kg, for urban soils (49). Total mercury levels were unremarkable in all three sediment samples, with respective findings of 0.02 and 0.03 mg/kg in Stations #1 and 3, increasing to 0.16 mg/kg in the beach lagoon sediment. "Normal" background for total mercury in sediment ranges from 0.01 to 0.5 mg/kg (50).

As with lead and especially iron, sediment concentrations of nickel, cadmium, and barium were significantly highest in the upper dump site sample (Table 5). None of the levels exceeded EPA health based risk standards for residential soils.

At the terminus of this pathway, the upper beach lagoon sediment sample (Station #5; see Table 5; Figure 2) only arsenic, chromium and magnesium appeared at levels greater than either of the two sediment samples taken from the dump site path above it. Even so, the levels of these three metals were well below EPA's health based risk numbers for residential soils (51). Again, most of the remaining metals, including lead and mercury, showed declining trends in the sediment taken from the lower part of this pathway (Station #5) as it approaches the sea.

Beryllium was present above the MDL, but not quantifiable, in all three sediment samples (Table 5). Normal background levels for beryllium in sediment are not available in the literature. However, EPA's risk based numbers for beryllium in urban soil and residential soil respectively, are 0.67 and 0.15 mg/kg (51). The MDL for the three samples ranged from 0.75 (Station #1) to 0.37 (Station #3) and 0.42.

6.1.2 Metals in Dump Site Water (Table 5)

Compared with the aqueous sample taken at the upper part of the dump site (Station #2; Figure 2, Table 5), the aqueous sample (Station #4) taken along the lower reach of the same stream shows a significant decline in all metals except aluminum (which increased about ninefold), and lead (a slight decline from 1.93 to 1.12 µg/l). The increase in dissolved aluminum could be a result of the dumping of spent aluminum containers in the vicinity. Sample #4, was extracted and analyzed twice as a QA/QC duplicate, generating two sets of data for most of the analytes evaluated at this station (see Appendix E).

Both calcium and alkalinity also decline greatly in the lower aqueous sample, by a factor of approximately 13. This roughly parallels an approximately thirteenfold decrease in iron. Sulfate levels also decreased nearly fivefold in the lower water sample.

Primary drinking water maximum contaminant levels (MCLs) or maximum contaminant level goals (MCLGs) were not exceeded in the two water samples from the dump. Other than iron and lead in Sample #2, and zinc in both samples 2 and 4, ambient water quality criteria for aquatic life were not exceeded. In Sample #2, iron exceeded the freshwater acute criterion for aquatic life by

about eightfold. Lead in Sample #2 was 1.93 µg/l, slightly above the chronic freshwater criterion for lead of 1.32 µg/l (52). Zinc was noted in Sample #2 at 237 µg/l, and in Sample #4 at 59.5 µg/l. Freshwater aquatic life criteria for zinc are 65.4 µg/l (acute) and 58.9 µg/l (chronic) (52).

For beryllium in the aqueous samples, the MDLs were at 0.3 µg/l, well below the EPA Drinking Water MCL of 4 µg/l for this metal (53). Beryllium MDLs were not sufficiently low to address the (very conservative and much lower) EPA risk based modeled concentration of 0.016 µg/l, which is modeled on carcinogenicity (51).

Manganese was measured in both water samples, at 141 and 27.4 µg/l, respectively. The secondary MCL for manganese, based on taste and odor and not health effects, is 50 µg/l (53). Freshwater ambient water quality criteria have not been established for manganese.

6.1.3 Organics in Dump Site Sediment (Table 6)

Residues of organics measured in the dump site sample pathway are shown in Table 6 and are discussed below.

6.1.3.1 Polyaromatic Hydrocarbons (PAHs)

In the upper dump sediment sample (Station #1), trace levels of the PAHs, pyrene (255 µg/kg), fluoranthene (227 µg/kg), anthracene (47.1 µg/kg, estimated) and fluorene (42.2 µg/l, estimated) were noted. All four of these PAHs are ubiquitous products of combustion of organic matter. No such combustion-related PAH residues were measured in the lower sediment (Station #3). However, the upper SQL for anthracene in this sample was a relatively high 66.6 µg/kg, which would have not been sufficient to detect anthracene in Sediment Sample Station #1. At the terminus of the sampling for the dump pathway, fluoranthene (noted in Sample #1) re-occurred at a lower estimated concentration, 57.3 µg/kg. No other PAHs were noted in the sediment at the lower beach lagoon.

Dibenzofuran, also associated with combustion of organic material, was estimated at 43.6 µg/kg in the upper sediment sample, but was not detectible in the two sediment samples from lower in the pathway.

Retene (also called phenanthrene, 1-methyl-7-isopropyl) was found in Sediment Sample #3 (lower dump), at 332 µg/kg. Retene is a "resin acid" associated with wood pulp and paper processing, and is normally found in pulp mill effluent. Retene was not measured in the upper sediment sample from the dump (SQL = 152 µg/kg). However, retene was measured once again at the terminus of the dump site pathway sampling, in Sample #5 (upper beach lagoon), at estimated levels of 51.1 µg/kg.

In the upper sediment, 4-methylphenol (p-cresol) was estimated at 51.3 µg/kg. Although not measured in the lower dump sample, the residue of 4-methylphenol increased to 175 µg/kg at the lower lagoon sediment. This compound is associated with auto and diesel exhaust, coal tar, and is also a natural product which occurs in plants (e.g., anise seed oil).

Sediment samples 1 and 5 also revealed trace estimated levels of chloroform at 2.2 and 1 µg/kg, respectively. Since chloroform is both an industrial solvent and a natural product sometimes associated with plant matter, it is difficult to speculate about the source of this material.

6.1.3.2 Pesticide Residues

Trace residues of the organochlorine pesticide metabolite, endrin ketone (57 µg/kg) were measured in sediment Sample #1. Endrin is a highly toxic and bioaccumulative organochlorine insecticide, whose agricultural uses have been greatly limited in the past decade because of toxicity to non-target organisms. However, such a finding of 57 µg/kg in dump site sediment is far below EPA's risk based endrin guideline of 23,000 µg/kg for residential soil (51). It would thus appear of only minor significance in this drainage, especially since no levels of endrin or its breakdown products were measured in the other two sediment samples taken further down the dump site pathway's seaward progression.

Estimated residues of the DDT series (mostly p,p'-DDD, at 132 µg/kg, with 35 µg/kg p,p'-DDE and 32 µg/kg p,p'-DDT) were also noted in sediment Sample #1 from the upper dump site pathway.

DDD was not measured in Sample #3, but was estimated at 10 µg/kg in the beach lagoon sediment. DDE was estimated at 9 µg/kg in Sample #3, and at 16 µg/kg in the beach lagoon sediment sample. p,p'-DDT was measured only in Sample #1, and did not appear lower down in the pathway.

For an agricultural area, and especially a dump site, these concentrations for the DDT series are certainly within reasonable background. The health based EPA risk concentrations for residential soil for DDD, DDE, and DDT are 2700, 1900, and 1900 µg/kg, respectively (51).

In sediment sample 3, a trace of endosulfan sulfate, a metabolite of the organochlorine pesticide, endosulfan (thiodan), was measured at an estimated 22 µg/kg. No endosulfan-derived residues were noted in the other two sediment samples from the dump drainage. EPA's health-based risk concentration for endosulfan in residential soils is 470,000 µg/kg (51).

Traces of the carbamate insecticide carbofuran (furadan; 7.2 µg/kg) and its metabolite 3-hydroxy carbofuran (18.1 µg/kg), were noted in the upper beach lagoon sediment. Another carbamate pesticide, mercaptodimethur (methiocarb; mesuro; often used to control snails, slugs, various insects, and also as a bird repellent) was measured in the lagoon sample 5 at 21.9 µg/kg. No carbamate pesticide residues were found in the two sediment samples taken from the upper and mid portions of the dump site drainage.

Phthalates (from plastic waste) were not measured in any of the three sediment samples, but the SQLs (especially for di-N-butyl phthalate) for sediment were quite high. The analysis would have been unable to detect any trace levels which might have otherwise been notable. However, two common phthalate compounds were found in both water samples taken from the dump stream (see below).

Ordnance compounds were not measured in any sample.

6.1.3.3 Two Novel Bromo and Iodo Compounds; Natural Products?

(See also Section 6.3.1.2.2)

Laboratory analysis (Table 6) revealed compelling evidence of the presence of two apparently ubiquitous halogenated compounds in the sediments taken from the dump site drainage. The two compounds are 4-hydroxy-3,5-dibromobenzoic acid (DBBA), and 4-hydroxy-3,5-diiodobenzoic acid (DIBA). There was evidence that DBBA was present at an estimated concentration of 19 $\mu\text{g/kg}$, in the upper sediment sample from the dump pathway, and at 9 $\mu\text{g/kg}$ in the lower sediment sample. It then was estimated with certainty (J) at 234 $\mu\text{g/kg}$ in the sediment sample from the terminus of the pathway; the upper beach lagoon. DIBA was not noted in the upper dump sediment (Sample #1, SQL of 127 $\mu\text{g/kg}$). However, it was estimated as likely (NJ; occurring at 61 $\mu\text{g/kg}$) in Sediment Sample #2, and found with certainty at an estimated 70 $\mu\text{g/kg}$ in the upper beach lagoon sediment below the dump.

The significance of these two halogenated compounds is not clear. The mass spectral properties for DBBA and DIBA, mimic those of the two synthetic herbicides, bromoxynil (3,5-dibromo-4-hydroxybenzonitrile, DBBN) and ioxynil (3,5-diiodo-4-hydroxybenzonitrile, DIBN), respectively.

As discussed later in the section 6.3.1.2.2, DBBA, DBBN, DIBA, and DIBN were also found in all seven tideflat sediment samples. Marine natural products containing bromine and iodine are commonplace (54),(55). However the presence of DBBA and DIBA at low levels in freshwater ecosystems like the sediment taken from the Dump Pathway poses several additional questions. Rationale for assuming DBBA and DIBA to be most likely natural products will be discussed in greater detail in the subsequent section on residues found in the sediments sampled from the Tideflats Pathway.

6.1.4 Organics in Dump Site Water

The aqueous samples from both the upper (Station #2) and lower (Station #4) portions of the dump site drainage revealed estimated traces of benzene at respective levels of 0.081 $\mu\text{g/l}$ (81 parts per trillion; ppt), and 0.068 $\mu\text{g/l}$ (68 ppt). Both levels are well below the drinking water MCL for benzene of 5 $\mu\text{g/l}$ (53). They are also well below the freshwater quality ambient criterion for human health (1.2 $\mu\text{g/l}$), based on ingestion of both water and aquatic organisms (56). Because the area around Station #1 was rife with discarded rusty automobile bodies which conceivably could still be leaking traces of fuel, this finding is not surprising.

Traces of the PAHs, acenaphthene and fluoranthene (found in crude oil, and also combustion products), were estimated respectively at 0.017 and 0.01 $\mu\text{g/l}$ in the upper aqueous sample, but no PAHs were noted in the lower sample.

Two phthalates frequently associated with plastic products such as bread wrappers and plastic bags were found in the water samples. Sample #2 from the upper site had di-n-butylphthalate at estimated levels of 0.075 $\mu\text{g/l}$. Sample #4 from the lower part of the dump had diethylphthalate at an estimated level of 0.28 $\mu\text{g/l}$.

Traces of dibenzofuran (combustion product) were estimated at 0.009 µg/l in the upper aqueous sample 2, but were not found in Station #4 lower in the dump site drainage.

Both water samples from the dump revealed the presence of residues of the chlorinated organic compound, bicyclo {2.2.1}hept-5-ene-2,3-dicarboxylic acid, 1,4,5,6,7,7-hexachloro-, also known as chlorendic acid. It was estimated at 0.49 µg/l in Sample #2, and at 0.56 µg/l in Sample #4.

Traces of the broad spectrum fungicide and wood preservative, PCP, were found in both water samples from the dump site drainage. PCP was estimated at 0.022 µg/l in Sample #2, and at 0.024 µg/l in Sample #4 taken downstream. Both findings are well below the EPA risk based concentration of 0.56 µg/l for tap water (51), as well as below the MCL of 1 µg/l (53). Both are also below the EPA freshwater criteria for aquatic life of 20 (acute) and 13 (chronic) µg/l, for PCP (57). In view of the long historical use of PCP in wood treatment, such levels in water from a dump site drainage pathway would not appear unusual.

Toxaphene, a complex and somewhat persistent chlorinated camphene with a long history of use as a "dip" for livestock, was estimated in Sample #2 at 0.82 µg/l. This is below EPA's drinking water MCL of 1 µg/l for toxaphene (53). However it exceeds EPA's risk-based toxaphene concentration for tap water (conservatively modeled from animal data, using carcinogenic slope factor and numerous statistical assumptions), which is 0.061 µg/l (51). Toxaphene was not measured in the lower water sample from the dump drainage, nor was it found in any of the three sediment samples. However, it should be noted in all sediments--especially Sample #1 and Sample #5, the SQLs for toxaphene were unfortunately very high.

Tentatively identified organics (TICs) from all five dump samples are shown in Table 7.

6.1.5 Concurrent Environmental Investigations on the Reservation: The "livestock dipping station"

The finding of low levels of a pesticide like toxaphene in the dump drainage water is not altogether surprising, in an area where livestock ranching is common. As is the case with many rural areas, at least one former ranching site near the Reservation is known to have contained a "livestock dipping station". The property in question, located at 2406 Tokeland Road, was purchased in 1994 by the Tribe to serve as a future housing development. In compliance with various BIA and Inter-Tribal Housing Authority land use requirements, a site inspection was performed by a private contractor in March, 1995, during which soil associated with the former dipping site was obtained and tested for various organics and metals. The results indicated the presence (above background) of lead, total petroleum hydrocarbons (TPH), diesel, TPH-oil, and the following pesticides: heptachlor, lindane, heptachlor epoxide, 4,4'DDD, 4,4'DDT, 4,4'DDE, and chlordane. This screening test did not specifically include toxaphene. (58).

Based on these findings of pesticide residues, EPA Region 10's Office of Environmental Cleanup tasked Ecology and Environment, Inc. to conduct a removal assessment at the site. This assessment took place on August 13, 1996, concentrating on the area surrounding the cattle dipping station (59). A total of four ground water samples and seven subsurface soil samples (from zero to six feet below ground surface) were analyzed, using field screening immunoassay

test kits. To verify the field immunoassay results, two field representative soil /water duplicates and additional soil and ground water samples were also sent to a commercial laboratory for independent analysis for pesticide residues.

For the ground water samples, no pesticides were detected above the instrument detection limits, and metals appeared consistent with the background sample and with the geology of the area (higher than normal arsenic concentrations). However, seven of the various soil samples contained levels greater than the EPA Region III risk-based concentrations (51) for one or more of following pesticides: alpha /beta /gamma /delta BHC; alpha /gamma chlordane; the DDT series, and heptachlor /heptachlor epoxide.

A sample of the water taken directly from the dip tank revealed respective levels of alpha BHC and delta BHC at levels of 0.23 and 0.21 ug/l.

Since the area is proposed as housing development for the Shoalwater Tribe, EPA Superfund Technical Assessment and Response Team has recommended a removal action, based on the concentrations of pesticides above the Region III risk based concentrations for soils, to reduce the threat to human health and the environment (59).

6.1.6 Microbiology: Dump Site Water and Leachate

Table 8 shows results of microbiological analysis of three aqueous samples taken from various points along the dump site drainage stream (see Figure 2).

Although *E. coli* numbers were comparable in both water samples, other bacterial indicators (total and fecal coliforms, and enterococci) were present in highest numbers at the spring head located at the origins of the small creek passing through the dump site (Station #16A). This may have been due to some agitation of sediment at the time of collection, or to the presence of toxicants in the leachate which can have bacteriostatic or bacteriocidal effects. Exposure to such substances could significantly alter the numbers and types of bacteria present in the leachate and post-leachate samples. In either case, there did not appear to be an abundance of indicators present in the leachate.

The purpose of the anaerobic/aerobic ratio (Table 8) is to establish the condition of the dump. An older, ideally operating dump that is composting well, should demonstrate a ratio of greater than 1. This ratio also describes the condition of the collected leachate. The area of the dump where this leachate was collected (Station #15) was composed mainly of rusty appliances and old car bodies. There appeared to be little organic material present. This collection station may not be representative of the entire dump, but it was the only obvious site of leachate runoff.

Of interest is the presence of *Clostridium perfringens* at the leachate collection Station #15. Pure isolates of this organism obtained from the leachate sample were tested for the presence of enterotoxin by reverse passive latex agglutination (Oxoid-PET-RPLA toxin detection kit). In this assay, *Clostridium perfringens* toxin was not detected. This organism is an opportunistic pathogen, and a causative agent of wound infections in humans, including "gas gangrene". Its presence is not indicative of anything in particular except perhaps continued anaerobic decomposition and long term organic contamination. However, since the organism's presence has

been confirmed at this station, care should be taken to protect against puncture wounds if any further sampling is done.

6.1.7 Conductivity Survey at the Dump Site

As part of the field measurements during sampling, an electrical conductivity survey of the stream that traverses the base of the dump was made on February 21, 1995. The objective of the survey was to use conductivity as an indicator to identify the extent of increased dissolved solids from dump leachate impacting the stream. Figure 7 shows the results of the survey. Six points were measured in the stream, two in an eastern tributary, two in adjacent marsh ponds, and one in an area of leachate discharging from the southern down gradient margin of the dump (Sample Station #2 referred to as upper dump site). During sample collection on February 22, additional measurements of conductivity and pH were measured at Station #2 (leachate/upper dump); Station #4 (downstream/lower dump); and Station #5 (slough), and are shown in Figure 8.

The conductivity of the stream upgradient of the dump was 128 microsiemens (μS), comparable to the value of 125 μS found in an eastern tributary unaffected by dump seepage (Figure 8). As the stream traversed the base of the dump, conductivity increased to 160-174 μS indicating increased concentrations of dissolved solids. Conductivity measurements of dump leachate at sample Station #2 were 692-736 μS , about 5-6 times the values for the stream upgradient of the dump. Based on mass balance, the increase in stream conductivity below the dump, compared with dump leachate, suggests that about 8% of the stream flow below the dump was contributed by dump leachate. Conductivity measurements shown in Figure 8 for marsh ponds down gradient of the dump suggest that they were also impacted by dump leachate, compared to ponds upgradient of the dump.

Inspection of the major inorganic parameters (Table 5) shows that dump leachate at the time sampled (Station #2) was a calcium bicarbonate water with a pH of about 7. As the stream that traversed the dump approached tidewater (lower Station #4), the major ion content changed to a sodium chloride water with a pH of 6.9. See section 6.4.1.2 for additional discussion of the general inorganic characteristics of dump site water in comparison with other water types sampled in this study.

6.2 Agricultural Runoff from Cranberry Bogs toward Tidelands (Figure 2, Tables 9 and 10)

6.2.1 Metals in Drainage Ditch Sediment (Table 9)

In general, metal residues noted in the two sediment samples from the cranberry drainage ditch were all lower than those seen in the lower beach lagoon (Station #5), and markedly lower than either of the sediment samples taken from the upper and mid portions of the dump site drainage. With the exceptions of arsenic (slight elevation), and manganese and barium (levels remained relatively constant), all metals in Sediment Sample #6 from the upper drainage ditch appeared in concentrations less than those detected in sediment for the lower beach lagoon. Sediment metals also appeared to decline as a function of distance from the agricultural lands. Based on the more seaward sediment sample (Station #8), nearly all metals had declined further from the

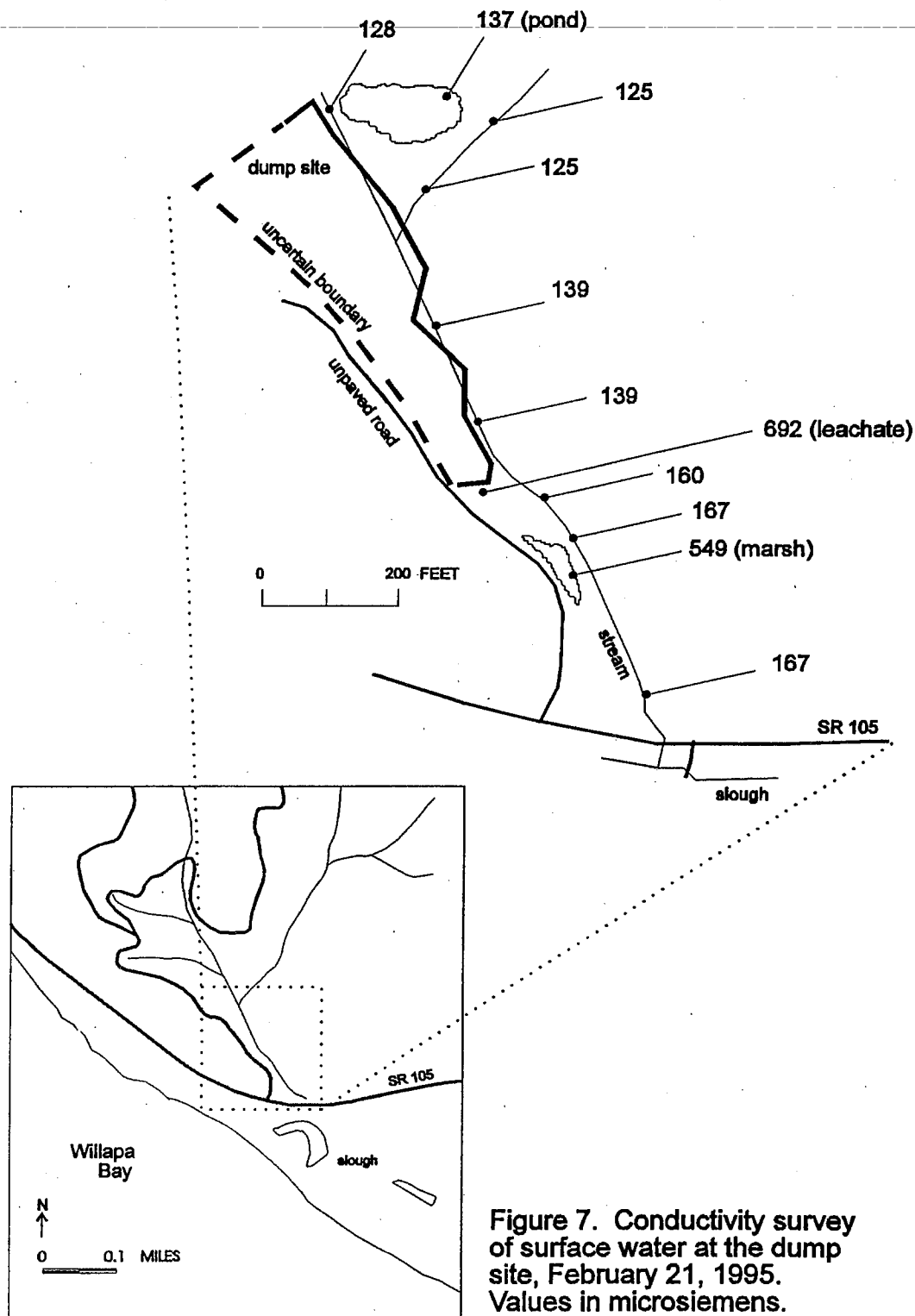


Figure 7. Conductivity survey of surface water at the dump site, February 21, 1995. Values in microsiemens.

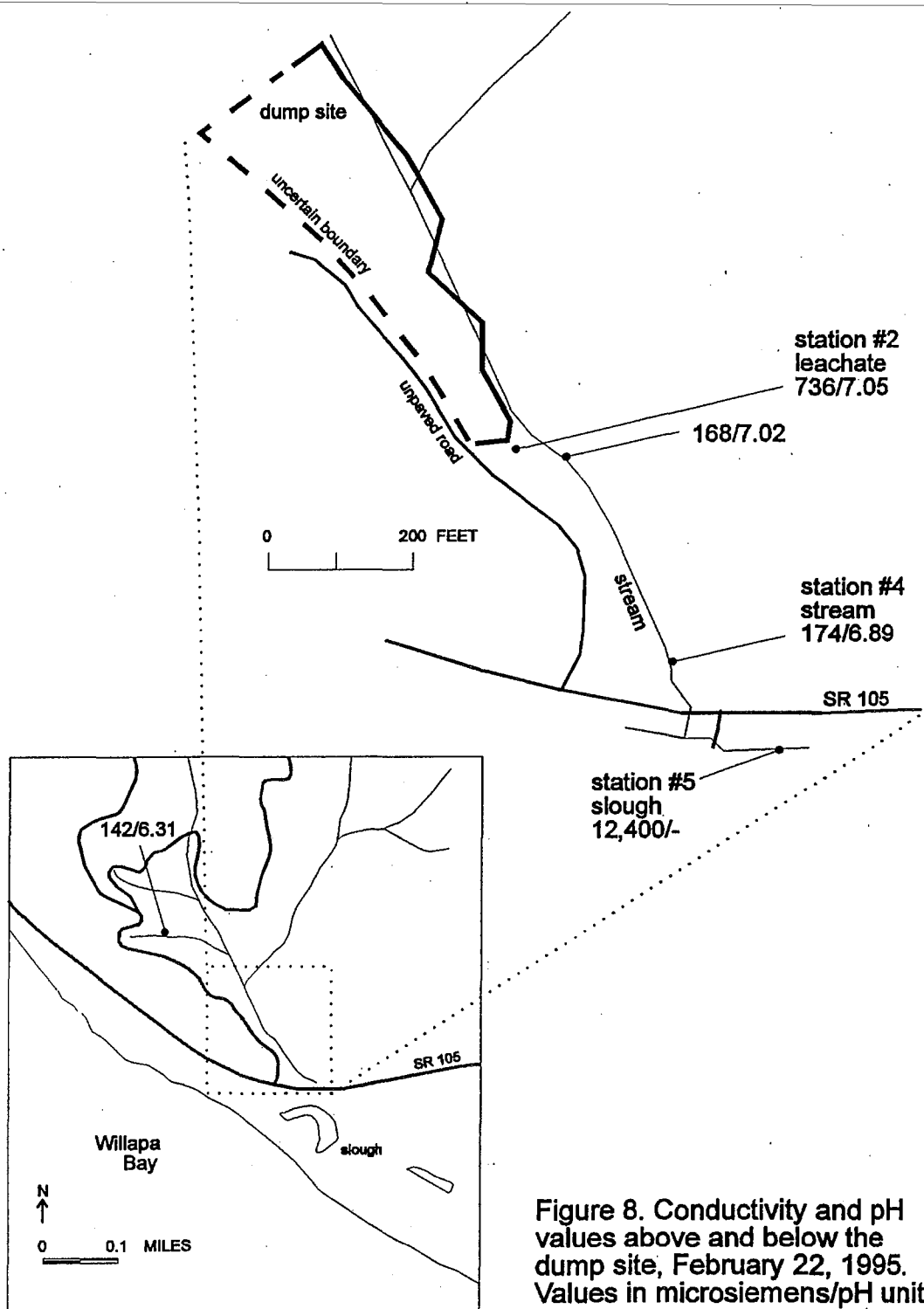


Figure 8. Conductivity and pH values above and below the dump site, February 22, 1995. Values in microsiemens/pH units.

concentrations noted at the upper part of the drainage path immediately below the cranberry bogs upstream. Exceptions to this pattern were nickel (slight increase, from 8.57 to 10.7 mg/kg, sodium (about a twofold increase, probably due to seawater intrusion and tidal influences), and potassium (levels remained constant). Except for selenium, all sediment concentrations were approximately within the mean sediment concentrations ("expected background") listed by Bowen (1979) (50). The selenium concentrations (an estimated 6.4 and 10 mg/kg) measured in the two samples were 15 and 23 fold greater than Bowen's "expected background " concentration.

6.2.2 Pesticides in Drainage Ditch Sediment (Table 10)

Both of the sediment samples from the drainage ditch appeared relatively unremarkable in terms of the variety and amounts of pesticide residues measured. The upper sediment sample (Station #6) contained estimated concentrations of the herbicide dichlobenil (2,6-dichlorobenzonitrile; casoron) at 10 µg/kg. Traces of dichlobenil were also estimated in the lower sediment sample (Station # 8) at 1.5 µg/kg. Traces of the four major DDT metabolites were also noted in the upper sample. The sum of these residues (total DDT) was estimated at 123.5 µg/kg (Table 10).

In the lower sediment sample (Station #8), only p,p'-DDD was found, at an estimated concentration of 3 µg/kg. No other pesticide residues were found in either sediment sample, nor were any other organic compounds measured.

6.2.3 Pesticides in Drainage Ditch Water (Table 10)

Somewhat paradoxically, both water samples displayed a much greater variety and extent of pesticide contamination than did the corresponding sediment samples taken at the same place (Figure 2 and Table 10). At the lower station (Sample #8), the substrate appeared to be a clear, hard sand that may not have accumulated pesticide residues. This issue is explored in more detail in later portions of this discussion.

6.2.3.1 Herbicides

As in the case of both sediment samples, both water samples showed traces of the herbicide dichlobenil, measured at 1.9 µg/l, and 2.0 µg/l, respectively, in samples 7 and 9. Dichlorbenzamide, which is a breakdown product of dichlobenil, was also noted at 0.14 µg/l in both water samples. Dichlobenil is registered as an herbicide for weed control in cranberry areas. It is also sometimes intentionally applied to water. According to the Weed Science Society of America, the halflife for dichlobenil in water under limited sunlight is 10.2 days (60). 96 hr LC50 for rainbow trout is from 4930 to 6260 µg/l (60). Neither a drinking water MCL nor an ambient water quality criterion exists for dichlobenil at this time. Since the levels noted in these water samples are more than three orders of magnitude below the 96 hr LC50 for sensitive salmonids, the levels of dichlobenil and dichlorbenzamide would not appear to be of concern.

The carbamate herbicide chlorpropham (isopropyl-3-chlorophenyl carbamate; CIPC) was also noted in both water samples, at estimated levels of 0.1 µg/l for each. According to the Farm Chemicals Handbook, the LC50 for chlorpropham (rainbow trout) ranges from 3020 to 5700 µg/l (61).

Napropamide, a substituted amide herbicide with a typical field half-life of about 70 days (60), was found in both water samples, at 0.2 µg/l. The Herbicide Handbook of the Weed Science Society of America indicates relatively low aquatic toxicity for this material citing a rainbow trout 96 hr LC50 of 16,600 µg/l (60).

The herbicide norflurazon was also measured in both samples (Station #7 at 1.0 µg/l and Station #9 at 0.78 µg/l). This herbicide has a moderate to long half-life of approximately 6 to 8 months in aerobic aquatic conditions, according to the Herbicide Handbook (60). The 96-hr LC50 for rainbow trout is listed at 8100 µg/l (60).

Both water samples also contained residues of the herbicide, 2,4-D. 2,4-D was measured at 0.12 µg/l in the upper ditch water and again in the lower ditch water sample at 0.091 µg/l. Ambient water quality criteria for 2,4-D have not been established at this time. The EPA drinking water MCL for 2,4-D is 70 µg/l (53), and the EPA risk-based modeled estimate for permissible levels in tap water is 61 µg/l (51). The rainbow trout 96-hr LC 50 for the isooctyl ester of 2,4-D is greater than 5000 µg/l. Comparable 96-hr toxicity levels for technical grade 2,4-D acid and 2,4-D-dimethylamine salts are about 377,000 µg/l, and 250,000 µg/l, respectively (60).

Triclopyr ([3,5,6-trichloro-2-pyridinyl]oxy]acetic acid; garlon) was also estimated in both upper (0.28 µg/l) and lower (0.023 µg/l) water samples from the cranberry runoff ditch. No drinking water MCL or ambient water quality criterion have been established for this herbicide. Although soil half-life averages about 30 days, triclopyr is rapidly degraded by photolysis in water, with a half-life at 10 hours at 25 degrees C, producing trichloropyridinol as a major metabolite (60). Chronic toxicity to aquatic organisms is quite variable, depending on the chemical species of triclopyr in question. Rainbow trout 96 hr LC50 for the technical acid form of triclopyr is 117,000 µg/l, while the comparable LC50 for the triethylamine salt is only 552,000 µg/l. In contrast, 96 hr rainbow trout LC50 for the butoxyethyl ester of triclopyr is 740 µg/l (60).

6.2.3.2 Insecticides

DDT Series: Similar to the two sediment samples, p,p' DDD was estimated in both corresponding water samples at 0.0088 µg/l at (upper) Station #7, and again at 0.01 µg/l at (lower) Station #9. These levels exceed the Washington State Ambient Water Quality Standards of 0.001 µg/l for total DDT (62). No other residues of the DDT series were noted in the two water samples.

Carbamates: The systemic broad spectrum insecticide /nematicide, carbofuran (furan; 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate), was measured in both water samples at 0.43 µg/l (Station #7), and 0.35 µg/l (Station #9). Carbofuran has a drinking water MCL of 40 µg/l (53). The EPA risk-based number for carbofuran in drinking water is 180 µg/l (51). No EPA ambient water quality criterion has been established for this pesticide. However, a Canadian water quality guideline of 1.75 µg/l has been noted in the available literature (63). The 96 hour LC50s for carbofuran range from 240 µg/l (bluegill) to 380 µg/l (rainbow trout) (61).

Organophosphates: Significant findings for three organophosphate pesticides were noted in both water samples. Of special concern was the detection of significant trace residues of the extremely toxic cholinesterase inhibitor, azinphos-methyl (guthion), in both water samples. A level of 0.21 µg/l was found in (upper) sample 7 and 0.22 µg/l was measured in (lower) sample 9. These levels

are more than an order of magnitude above the chronic EPA ambient water quality criterion of 0.01 µg/l for guthion (57), and likewise exceed water quality standards for the State of Washington (62). Although no drinking water MCL has been established for guthion, its extreme acute mammalian toxicity (oral rat; approximately 4 mg/kg)(61) makes it potentially one of the most hazardous of all organophosphate pesticides in use today. Consequently, any residues in surface water which might come in contact with aquatic life, or with incidental human wading or swimming activity should be of concern.

Chlorpyrifos, which is of increasing environmental concern because of its relative persistence and moderate to high toxicity, was also found in both samples. The upper water sample (Station #7), was estimated at having 0.044 µg/l, and 0.046 µg/l was estimated for the lower water sample (Station #9). Both levels exceed the chronic Washington State Water Quality Standard of 0.041 µg/l for this pesticide (62). The National Academy of Sciences (NAS) has also recommended a maximum concentration in ambient waters of 0.001 µg/l for chlorpyrifos (64).

Diazinon, a moderately toxic organophosphate, was also measured in both water samples. Sample #7 had 0.23 µg/l diazinon, and Sample #9 contained 0.27 µg/l. EPA has not established ambient water quality criteria for this pesticide but the NAS has recommended a maximum concentration of 9 µg/l (64). EPA's lifetime health advisory for diazinon in drinking water is 0.6 µg/l (53).

These findings confirm concurrent studies by the State of Washington, which during both 1994 (65) and 1995 (66) have measured these same three organophosphate pesticides in a similar cranberry bog drainage at values which either exceed USEPA criteria or Washington State water standards for water quality, or are in excess of the NAS recommendations for maximum concentrations in surface waters. In 1994, the Washington State Pesticide Monitoring Program also noted similarly excessive levels of these three pesticides in water samples collected throughout much of the growing and harvest seasons from Grayland Ditch No. 1 (segment no. WA-24-1030), which originates in Long Lake and flows to North Cove in Willapa Bay. Their findings reported azinphos- methyl at 0.14 µg/l in Grayland Ditch water during sampling in June, 1994 (65). (USEPA Water quality standard is 0.01 µg/l) (57). Their study also found chlorpyrifos residues in Grayland Ditch water at 0.021 µg/l (June, 1994), and again at 0.03 µg/l (October, 1994) (65). Although this is within the current Washington State water quality standard of 0.041 µg/l for this pesticide (62), it is well above the NAS recommended maximum level of 0.001 µg/l (64). The Washington State monitoring effort also measured diazinon residues in Grayland Ditch at 0.011 µg/l (April, 1994) and again at 0.029 µg/l (October, 1994) (65). Both values exceed the NAS recommended maximum concentration of 0.009 µg/l (64).

During 1995, the Washington State pesticide water monitoring data for Grayland Ditch No. 1 continued to reveal consistently elevated concentrations of the same three organophosphate pesticide residues (66). Azinphos-methyl was detected in the 1995 water samples at 0.21 ug/l (June), 0.48 ug/l (August), and 0.018 ug/l (October). Respective 1995 (ug/l) findings for chlorpyrifos in Grayland Ditch samples were 0.045 (April), 0.012 (June), 0.13 (August), and 0.016 (October). Comparable (ug/l) 1995 findings for diazinon were 0.014 (April) 0.22 (June), 0.68 (August), and 0.030 (October). The 1995 Washington State monitoring also revealed consistently elevated levels of total DDT in the Grayland Ditch water samples. In ug/l, These

were: 0.019 (April), 0.014 (June), 0.020 (August), and 0.017 October) (66). All were well above the Washington State water quality standard for total DDT, which is 0.001 ug/l (62).

The question of "sediment": The above discussion makes it clear that significant pesticide residues were found in both water samples from the cranberry drainage. However, a lingering question about these findings is the relative absence of pesticide residues in either of the two corresponding "sediment" samples (Table 10). Although most organophosphate pesticides are relatively labile (with the exception of chlorpyrifos, which can remain in environmental media for months), many if not all of the residues noted in water would be expected to also bind preferentially to sediment.

Why, then, were so few pesticide residues noted from the two sediment samples in this study? A possible explanation of this discrepancy is that the samples collected may have actually been "hardpan", which had been swept clean of fine particulates, rather than sampling true stream "sediment". While obtaining the field samples, it was noteworthy that the bottom of the drainage ditch was very hard and firm, making it difficult to obtain any benthic material at all without great effort in breaking into the hardpan surfaces. It is possible that fine sediment particles are simply swept down the ditch, rather than being deposited uniformly on the bottom.

6.3 Tidelat Sediments and Shellfish associated with nearby tribal subsistence harvesting and mariculture

6.3.1 Sediment Screening for Chemical Contaminants (Tables 11, 12, 13)

Originally, five samples of sediment (#10, #11, #12, #13, and #14) were obtained August 8, 1994, from Willapa Bay tidelands (see Figure 3, Table 2). Two more intertidal sediment samples were obtained for comparative purposes the following year. On February 21, 1995, sample #23 (tideland in South Bay off Grays Harbor), and February 22, 1995, sample #12A (a resampling of Sample #12; the Swimming Hole), were obtained.

6.3.1.1 Metals (Table 11; Table 12)

The results of metal and organometal measurements in the six Willapa Bay sediment samples, and the Grays Harbor "reference" sample #23 are shown in Tables 11 and 12. Sample #23 was also measured as a field duplicate sample (see Appendix E). Organometal target compounds such as methyl mercury, which were not measured in Willapa Bay sediment samples, are listed in Appendix C, Table C-6.

In general, metal residues detected in all seven samples were unremarkable, well within reasonable background, and well below existing sediment criteria (48),(67). An interesting finding was that the Willapa Bay samples revealed lower residues than were noted in the single reference sediment sample from Grays Harbor.

Organotin compounds were noted in trace levels at sediment samples #10 and #12 from Willapa Bay. Sample #10 had an estimated 6.4 µg/kg of butyltin trichloride, and 8.8 µg/kg of tributyltin chloride. The sample at Station #12 (Swimming Hole) contained 21.6 µg/kg of dibutyltin

chloride, and an estimated 1.4 µg/kg of tributyltin chloride. No organotin residues were measured when Sample #12 was resampled (as Sample #12A). The presence of organotins would not be unexpected in such an area, because of the historic widespread use of organotin compounds in anti-fouling paints on boat hulls. In terms of ecological effects to nontarget organisms, tributyltin is most toxic, followed by dibutyl and monobutyl tins (68). At this time, no specific sediment criteria for the various organotins have been set for marine sediment. However, EPA Region 10 currently uses a guidance level for tributyltin; tentatively established at 30 µg/kg as total tin (dry wt) (48),(69). The levels of organotins noted for the two Willapa Bay samples would not be unexpected for sediment in typical harbors and marinas along Coastal Washington, but are probably above what might be considered "background" for this relatively well-flushed area.

Methyl mercury was not measured in any sediment sample, but #12A showed a lower SQL of 5.76 µg/kg. The Grays Harbor sediment (#23) also showed a lower SQL (6.56 µg/kg). For the remaining five Willapa samples, SQLs for methyl mercury were unfortunately all very high, ranging from 110 to 170 µg/kg (see Appendix C, Table C-6). Therefore no information about possible low levels of this compound could be obtained.

Because of the uncertainty about methyl mercury being present at all, it is difficult to speculate further about any possible environmental impact.

6.3.1.2 Organics (Table 12; Table 13)

All seven Willapa sediment samples, as well as the reference sample from Grays Harbor, were relatively unremarkable in terms of organic contaminants measured. Specific comments about certain contaminants which were noted are as follow:

6.3.1.2.1 The Swimming Hole

Samples #12 and 12A were taken from the Swimming Hole (Figure 3, Table 12; Table 13), which was of particular concern to the Tribe because of location very near the main Tribal Headquarters and its frequent use by children and subsistence fishers. Station #12 sediment contained (estimated) 4.0 µg/kg ethyl benzene, and 19.8 µg/kg carbon disulfide. Ethyl benzene is commonly used in the process of making rubber, and is also a chemical precursor in the production of styrene. No ethyl benzene was measured in the second sample taken from this station. Carbon disulfide was also measured in #12 sediment, at 19.8 µg/kg. Although carbon disulfide is used in large quantities worldwide as an industrial chemical intermediate, it also occurs naturally at trace levels throughout the oceanic environment. Carbon disulfide is especially common in marshlands, where it is produced by microbial reduction of naturally occurring sulfates. Therefore, such a finding in nearshore marsh sediments is not surprising. However, carbon disulfide was not measured in any of the other six sediment stations, from either Willapa Bay or Grays Harbor.

Traces of trichloromethane (chloroform) were estimated at 1.1 µg/kg in one of the two samples from the Swimming Hole (Station #12A). Chloroform was also estimated at 0.06 µg/kg in the Grays Harbor reference sample, but was not noted in any other samples. Since chloroform is not only an industrial chemical but also a natural constituent of various plant material, it is difficult to speculate on the source of this material. These estimated trace levels, found in only two of the seven samples do not appear significant in terms of health or environmental risk.

4-Methylphenol (p-cresol) was found in Sample #12A at 205 µg/kg, but was not measured in any of the other six Willapa Bay sediments. Like trichloromethane, 4-methylphenol was also found in the Grays Harbor reference sediment, at an estimated 54.6 µg/kg. Possible sources of this chemical, especially the relatively high levels noted in the first sample taken from the Swimming Hole (but not the second sample of this same station) are difficult to speculate upon. 4-methylphenol is a known constituent of automobile and diesel exhaust, and is a coal tar product. However, it is also a natural product of plants. Although interesting, such trace levels are probably not significant in terms of health or environmental risk from this exposure pathway. In 1994, hexachlorobenzene was also estimated at 10.3 µg/kg in the #12 swimming hole sample. This chemical is a common chemical intermediate in many industrial processes such as the manufacture of rubber and polyvinyl chloride (PVC) plastics. It is also utilized as a fungicide. In 1995, hexachlorobenzene was not measured in the sediment sample (#12A) taken previously from the same station.

Retene, a resin acid commonly associated with wood pulp and paper processing, was also found in Sample #12A, at an estimated 31.8 µg/kg. It was not found in the other sample from this same station, nor was it found in any of the other four samples from Willapa Bay, or in the Grays Harbor reference sample.

Pyrene, a PAH associated with combustion of organic materials, was estimated in Willapa Bay Sediment Sample #10 at 17.2 µg/kg but was not measured in the other sediment samples. Fluoranthene, another PAH associated with the combustion of organic matter, was estimated at 44.1 µg/kg in the Grays Harbor reference sample (#23).

6.3.1.2.2 Two Novel Halogenated Compounds: DBBA and DIBA (see Table 12; see also Section 6.1.3.3)

As noted in the three previously discussed sediments from the dump site drainage (see Table 6, Figure 2, Stations #2, #4, and #5), two unusual halogenated compounds were also measured in all seven Tideland sediments. These two compounds were DBBA, and DIBA. Both were present in all five original Willapa sediment samples collected on August 19, 1994. Both were also noted in a sixth Willapa sample taken six months later, in February, 1995. Both were also found in February 1995 "reference" sediment taken subsequently from Grays Harbor (Station #23).

As discussed previously, the mass spectral responses of the novel compounds DBBA and DIBA and the synthetic herbicides, bromoxynil and ioxynil, are identical. However, for reasons discussed later in this section, we hypothesize that these two compounds are most likely natural products, rather than actual herbicide residues applied intentionally to the ecosystem as xenobiotics (e.g., along roadsides to control weeds).

Concentrations of DBBA and DBBN in the original five Willapa samples, (August 19, 1994), ranged from 10 µg/kg in Sample #13, to 205 µg/kg in Sample #12. Average concentration for DBBA and DBBN in the six Willapa samples was 95.1 µg/kg. Concentrations of its iodinated analogs, DIBA and DIBN, ranged from 44.0 (Sample #10) to 244.0 µg/kg (Sample #12), with a mean concentration for the six Willapa samples of 153.5 µg/kg. Highest concentrations of all four analogs were found in sediment Sample #12 (but declined in the repeat sample of this station, #12A). Lowest concentrations for both compounds were found in Sample #13. In every Willapa

sediment sample except #12A (in which levels of DBBA and DIBA were much lower, and nearly equal) concentrations of DBBA were always significantly greater than those of DIBA.

Because of the presence of these two apparent "herbicide" analogs in all of the initial five Willapa sediments sampled in August of 1994, six months later an additional two sediment samples were obtained for further verification, from both Willapa Bay (Station #12A) and a geographically separate tideflats ecosystem (Grays Harbor; Station #23). (see Figures 1 and 3). Sample #12A (Swimming Hole) was again determined to be positive for both DBBA and DIBA, although at considerably lower levels than seen in the sample taken six months previously (#12) from that station. Even more surprisingly, the Grays Harbor sediment (#23) also contained residues of the same two compounds but in a reversed ratio from that usually seen the Willapa samples. Sample #23 contained estimated concentrations of 231.0 µg/kg DBBA, and 167.0 µg/kg DIBA. Reasons for reversal of this ratio in the Grays Harbor sediment are currently unknown.

● **DBBA and DIBA: Natural Products?**

As mentioned previously, the EPA mass spectral library tentatively identifies DBBA as an analog of the synthetic herbicide, bromoxynil. It also identifies DIBA as analogs of the synthetic herbicide, ioxynil. From our findings, however, it appears most likely that these four halogenated compounds, DBBA, DBBN, DIBA, and DIBN, are natural products, rather than xenobiotic compounds intentionally applied to the Willapa or Grays Harbor ecosystem as herbicides. Reasons in support of this premise are as follow:

1. Estimated residues of the four analogs were found consistently in all six samples of marine sediment from Willapa Bay, as well as in the totally unrelated marine sediment sample taken from Grays Harbor; a separate large estuary thirty miles to the north.
2. The synthetic herbicides, bromoxynil and ioxynil, are known to photolyze and biodegrade in the environment. Bromoxynil normally does not persist in surface or sediments longer than six to eight weeks (70),(71),(72). Ioxynil is cited as having a half-life in soil of less than two weeks (73). Even at different sampling times six months apart, in late summer and mid-winter, both DIBA and DBBA were still always noted at significant levels, in every sample. This does not argue for the presence of an intentionally applied labile xenobiotic such as these two synthetic herbicides.
3. According to Meister (1996) (61), ioxynil is not marketed as a herbicide in the U.S. at this time. Although bromoxynil is a common herbicide in U.S. agriculture, neither substance is known to be utilized for rights-of way or agricultural purpose in the Willapa Bay or Grays Harbor, or at the fall /winter season when samplings were conducted.
4. Traces of DBBA and DBBN were also noted in both sediment samples (#1 and #2; see Table 6) from the (freshwater ecosystem) dump site drainage, as well as at 234 µg/kg in the sediment from the lower (marine ecosystem) beach lagoon (Sample #5). Although DIBA was not seen in the upper dump sample, the minimum level of detectability for that compound in that sample was 127 µg/kg. DIBA was, however found at 61 µg/kg in the lower dump sediment, and at 70 µg/l in the lower beach lagoon sediment (#5). Levels and

ratios of both DIBA and DBBA in the sediment sample (#5) from the lower beach lagoon (dump site drainage) are consistent with those seen in all six tideflat sediments taken from Willapa Bay per se. Such ubiquitous occurrence also argues in support of a natural product hypothesis.

6.3.2 Microbiology

6.3.2.1 Shoalwater Bay Shellfish and Seawater Evaluation (Table 19)

The standard used by both the US Food and Drug Administration (FDA) and the Washington State DOH for regulating the consumption of molluscan shellfish is based on a fecal coliforms standard targeted at the overlying seawater in which shellfish exist. For over twenty years this standard has been based on a geometric mean (GM) most probable number (MPN) of 14 fecal coliforms /100 ml. Because of the variability of fecal coliforms in seawater, as measured by the MPN method, numerous samples must be collected over a protracted period of time at various stages of the tide before a valid evaluation can be made. Consequently, the collection of one seawater sample and one shellfish sample can only give a brief snapshot of shellfish conditions at a given sampling locale.

As shown in Table 19, razor clams collected at Willapa Bay's North Cove did exceed the market standard for non-depurated shellfish as described by FDA (13). Since the Geometric Mean MPN is used in establishing registered shellfish beds, the use of a single point test in determining the quality of water /shellfish is not recommended. Further testing of the shellfish and overlying seawaters would be required to more fully evaluate the microbial safety of the shellfish. The level of fecal coliforms in nearby seawater was indeterminately low at <18 /100 ml.

Although total coliforms, enterococci, and marine heterotrophic plate counts (MHPC) are not covered by either FDA or Washington State DOH shellfish growing water regulations, their occurrence in seawater can often help delineate the "freshness" of coliform contamination and the effects of rain water or snow melt runoff. The closer together the total coliform and fecal coliform values become, the more likely that contamination is due to recent fecal sources. Conversely, the farther apart total coliform and fecal coliform values become, the more likely that contamination is due to recent soil runoff.

Although based upon a single data set, the low total coliform and fecal coliform values found in seawater at all three locations (Table 19) indicate a soil runoff issue rather than a nearby fecal source. However, more samples collected during or following a major rainfall event could substantially alter this preliminary finding.

Another useful indicator of fecal contamination is the enterococcus group. Like fecal coliforms, they indicate the presence of fecal contamination from warm blooded animals, but unlike fecal coliforms, they survive longer in seawater. The combination of high numbers of enterococci, low fecal coliforms and elevated total coliform measurements in littleneck clams collected from the Tribal shellfish harvesting area point to long term contamination from aquatic animals and/or insects possibly associated with nearshore vegetation. The high concentration of marine microorganisms revealed via MHPC, tends to further confirm this observed association.

Table 19. Microbiology Measurements of Shellfish and Nearby Seawater Samples

Station Number	17	17	18A	18A	18B	18B
Location	Tideflat near Cedar River, Oyster Bed	Tideflat near Cedar River, Oyster Bed	SBIR, Shellfish Harvesting Area	SBIR, Shellfish Harvesting Area	Willapa Bay, North Cove Beach	Willapa Bay, North Cove Beach
Media	Oysters	Nearby Seawater	Littleneck Clams	Nearby Seawater	Razor Clams	Nearby Seawater
EPA Sample Number	95200021	95200020	95200025	95200024	95200023	95200022
Total coliform 100 g/ml	78	20	2,400	20	230	<18
Fecal coliform/ <i>E. coli</i> 100 g/ml	<18	<18	<18	<18	230	<18
<i>Enterococci</i> CI/100 g or ml	<18	<18	2,800	<18	790	<18
Marine HPC/ 1 g or ml	17,000	2,500	18,200	900	250	25

Not surprisingly, the highest concentration of all bacterial indicators was found in shellfish rather than nearby seawater. Bivalve shellfish, being filter feeders, have the ability to concentrate bacterial contaminants more than ten times above ambient background levels (74).

6.3.2.2 Occurrence of Microbial Contaminants in Tribal "Swimming Hole" (Table 20)

In Washington State, the bacteriological standard for recreational waters is fecal coliforms, and is based on a GM of 200 /100 ml and collection of a minimum of 5 samples per week. Because of the variability of the MPN method, numerous samples must be collected over an extended time at various stages of the tide, before a valid evaluation can be made. Therefore, collection of a single sample, as was done in this evaluation, will provide only an estimate of the actual risk. As shown in Table 20, the sample collected from the "Dexter-by-the-Sea" station (Sample #12) met State recreational standards for fecal coliforms. Conversely the second sample near Davis house exceeded the State standards for fecal coliforms.

The EPA recreational standard for *E. coli* in fresh water is a GM of 126 /100 ml, assuming at least 5 samples are collected per week. Generally speaking, the use of an *E. coli* standard for marine waters is not recommended. However, in instances such as Station #12A, located north of the "Swimming Hole", where the fecal coliform and *E. coli* numbers are equivalent, these results further confirm that the bacterial contamination is of fecal origin rather than from soil or wood by-products.

The EPA recreational standard for enterococci in marine water is a GM of 35/100 ml, assuming at least 5 samples are collected per week. As shown in Table 20, neither seawater sample exceeded recreational standards for enterococci. As a general rule, septic drainfield waste will contain a

Table 20. Microbiological Measurements of Swimming Area Samples

Station Number	12	12A	Transportation Blank
Location	SBIR, Swimming Hole, Dexter-by-the-Sea	SBIR, Swimming Hole, near Davis House	
Media	Water	Water	Water
EPA Sample Number	94350125	94350126	94350127
Fecal coliforms #/100 ml	12	570	<1
<i>E. coli</i> #/100 ml	12	570	<1
Enterococci #/100 ml	<1	13	<1
<i>Pseudomonas aeruginosa</i>	<1	<1	<1

higher proportion of fecal coliforms than enterococci, as its bacterial load. This is further indication that the fecal contamination seen in the northern sample is a result of a faulty drainfield system rather than fresh fecal waste from wildlife.

Pseudomonas aeruginosa is an organism that is ubiquitous in nature and is considered an opportunistic pathogen that can cause nasopharyngeal and skin infections. For this reason, its presence is tested for in swimming pools and water parks. The single sample standard in these recreational waters, is 1/100 ml. At present, no standard exists for natural bodies of water and the applicability of this standard to seawaters is uncertain. Table 20 demonstrates that if this standard is applicable to seawater samples, neither sample exceeds this level.

In conclusion, the sample of the actual swimming hole (Station #12; Dexter-by-the-Sea; Table 20) met recreational standards for swimming waters. However, the sample selected north of the swimming hole demonstrated evidence of recent fecal contamination and may be the site of a faulty septic system.

6.3.3 Aquatic Ecosystem Health: Shellfish Gonadal Histopathology Preliminary Screening Bioassay: "Swimming Hole" and North River /Smith Creek Junction

It is well established in the literature that there has been an increase in the numbers and types of tumors in fish and shellfish in the past several decades. In most cases, the increase in tumors and a variety of other pathologic conditions can be correlated with increases in aquatic toxicant levels (75),(76),(77). Two recent epidemiologic investigations identified the prevalence of gonadal cancers as high as 40 % in softshell clams *Mya arenaria* in Maine (75), and 60 % in hardshell clams *Mercenaria spp.* in Florida (78). A second study of these same geographic regions identified human cancer mortality rates due to ovarian cancer as significantly greater than the national average (79). The research and epidemiologic evidence has shown that the appearance of significant numbers of tumors in these clams (and humans) is correlating to increased use of herbicides and agrochemicals used in forestry and citrus farming. Since the softshell clam is a good molluscan indicator species, it was decided that populations indigenous to Willapa Bay could be studied in an effort to begin to characterize general "ecosystem health" near the Shoalwater Bay Reservation. A histopathological study of softshell clams was examined by EPA's National Health and Environmental Effects Laboratory, Atlantic Ecology Division, at Narragansett, Rhode Island. In September of 1995, 24 specimens were collected at the "Swimming Hole", located within the Shoalwater Bay Reservation. In addition, 27 specimens were obtained from the North River and Smith Creek junction at the point of entry into Willapa Bay.

No tumor bearing clams were found at either site. Based on statistical probability, if the prevalence rate of gonadal tumors was greater than 5-6 % for these Willapa Bay populations, one would have expected to see at least one tumor-bearing clam. Therefore, if a disease exists then the prevalence rate is not statistically likely to exceed 5-6 % (80). Although this is only a preliminary sampling of a molluscan indicator species, the lack of any tumors is supportive of a relatively "clean" environment in terms of xenobiotic chemical stressors and ecosystem health.

6.4 Drinking Water: Household Sampling

Limited studies of tribal drinking water sources have been conducted in the past as part of water resources investigations, for example by Lum (1984) (81), and Ebbert and Payne (1984) (82). A comprehensive study involving all water supplies used by tribal members both on and nearby the reservation, however, has yet to be undertaken.

6.4.1 Chemistry: Tap Water Screening for Lead and Inorganic Parameters (Tables 14, 15, and 16; Appendix C)

Drinking water station locations are designated by numbers keyed to Figures 4, 5, and 6. Station descriptors are used to designate clusters of samples in different areas at the Reservation as follows: "Reservation-West", along SR 105, "Reservation-Center", on SR 105 near the intersection with Tokeland Road, "Reservation-East" on Tokeland Road, and "Reservation-Annex" above SR 105. Sample descriptors are also used for designating samples obtained from the nearby communities of Westport, Grayland, South Bend, and Ocosta.

- **Lead**

Results for lead are listed in Tables 14 and 15. Low concentrations of lead were detected in 22 of 32 samples (69%) sampled by the "first-pour" technique (Table 14). None of these samples contained lead exceeding the action level of 15 µg/l established by the Safe Drinking Water Act (53). The highest lead concentration was 6.28 µg/l, measured in Sample #25, located in the "Reservation-East" area. Nine additional samples had "first-pour" lead concentrations ranging from 1 to 5 mg/l, and twelve samples had lead concentrations between 0.5 µg/l and 1 µg/l.

Low concentrations of lead were found in only two of the 19 stations sampled after flushing the distribution system. Both of these stations had concentrations between 0.5 µg/l and 1 µg/l.

Table 14 shows a comparison of 13 stations which were sampled by both the "first-pour" and the "flushed" technique. The lower "flushed" lead values in this comparison indicate that flushing is effective in reducing lead concentrations. The samples which had lead concentrations greater than 1 µg/l in first-pour samples include both on and off-Reservation systems (see Figures 4 - 6, Table 14). In either case, more samples at additional points along the distribution lines are needed to determine whether the source of lead is in household pipes or in the distribution systems.

- **Complete Inorganics (Tables 15 and 16)**

Tables 15 and 16 list results for the complete inorganic analyses conducted at 19 drinking water stations. Figure 9 shows the major cations and anions in a trilinear diagram (after Piper, 1944) (83). Inspection of Figure 9 indicates the main water types are calcium bicarbonate and calcium-sodium bicarbonate waters. The pH of samples ranged from 7.0 to 8.8 (Table 16). Electrical conductivity ranged from 130 to 360 µS. Summation of measured analytes indicates that dissolved solids range from 60 to 170 mg/l.

The lowest dissolved solids for any of the water systems sampled was measured for the South Bend sample (Station #44), the only station served by a surface water source. The highest dissolved solids sources were the Westport water system sample (Station #47), the private wells for a Bay Center business (Station #45), and the Toke Point well (Station #50). The higher dissolved solids at the Westport and Toke Point samples is accompanied by somewhat elevated sodium and boron, indicating a minor but measurable influence of marine water.

Samples from the main Reservation water system have a relatively more narrow pH range of 7.7 to 8.8, with electrical conductivities ranging from 170 to 174 μ S. Summation of analytes reveals a dissolved solids content of 104 to 106 mg/l. In general, the Reservation Annex samples are similar in proportions of major ions but somewhat higher in dissolved solids (about 118 mg/l).

No exceedances of primary drinking water standards, other than total coliforms (as discussed in the following section on Microbiology), were detected at any of the drinking water stations sampled in this survey.

Secondary drinking water standards, however, were exceeded for manganese at six stations, and for iron at five stations, as listed below (Table 17). Secondary drinking water standards have been developed for aesthetic purposes such as staining, taste and color. The secondary drinking water standards for manganese and iron are 50 μ g/l and 300 μ g/l, respectively (53).

Of those samples that exceeded secondary standards for manganese or iron, two were located at the main Reservation (Station #48) and Toke Point (Station #50) wellheads, and two (Stations #38 and #39) were at the annex buildings. The remaining three exceedances were found at off-Reservation stations served by private wells (see Table 15). These were Stations #41 and #42 at Ocosta, and Station # 45 at Bay Center. The highest iron concentration (4930 μ g/l) was found at the main Reservation well; Station #48. Since concentrations at all residence taps sampled on the main Reservation distribution system were less than 22 μ g/l, the water treatment used for the Reservation system appears to effectively remove iron prior to distribution.

6.4.2 Microbiology: Source Water Screening for Microbiological Contaminants from Leaking Septic Systems (Figures 4 - 6, Tables 17 and 19)

As shown in Table 4, drinking water from each home or building sampled in October 1995, for lead and inorganic parameters was also sampled for microbiological contaminants. However, unlike the previously discussed samples collected for analysis of lead and other inorganics, which were always taken directly from an inside user tap at each station, samples collected for microbiological testing were preferentially taken at an outside source at each house or building. This is routinely done to avoid the possibility of microbiological contamination by human activities near, for example, a kitchen, bathroom, or laundry faucet. Unfortunately, Sample Stations # 34 and #42 lacked an outside source, making it necessary to collect microbiological samples at these two locations from indoor taps.

As shown in Figure 6, three wells provide drinking water to the homes / buildings located on the Shoalwater Bay Indian Reservation. Well #2, treated by chlorination, provides water to the majority of the homes on the reservation. The other two wells provide water to only one or two homes /buildings and are apparently untreated.

To our knowledge no prior studies have been conducted on possible microbiological contamination of drinking water systems at the level of individual households or buildings in the Shoalwater Bay area. However, in 1993 EPA Region 10 did collect and analyze drinking water samples from the Shoalwater Bay Indian Reservation Well #2, and performed microbiological analyses for total /fecal coliforms, HPC, and *Giardia / Cryptosporidium*. These samples were collected from the well prior to chlorination (9),(10),(11). The samples were negative for all routinely sought chemical and microbiological analytes at that time. Since the 1993 sampling, it has been reported that all distribution lines supplying buildings from this well have been replaced.

In this study of individual households/buildings in the area, a total of 38 bacteriological samples (including two transfer/transport blanks) were collected from 36 stations both on and off the Shoalwater Bay Indian Reservation. All but two (Station #34 and Station #42) were taken from appropriate outside sources at each station. Locations of the drinking water microbiological samples, obtained from the Shoalwater Bay area on October 23 and 24, 1995, are shown in Figures 4 - 6. Microbiological results are shown in Table 18.

None of the drinking water samples tested positive for fecal coliforms (Table 18). However, five samples were found positive for total coliforms. These were Samples #31 (1 colony forming unit (CFU) /100 ml, #34 (1/100 ml), #35 (1/100 ml), #36 (3/100 ml), and #42 (1/100 ml). Three of the positive samples (# 31, #35, and #36) were located on the Shoalwater Bay Reservation. Sample #34 was taken from a private residence in Grayland, and Sample #42 came from a private residence in Ocosta (Figure 5).

Because of the positive results on the initial sampling, these five positive stations were sampled again three months later, on January 22, 1996. Again, no sample was found positive for fecal coliforms. In this resampling effort, Sample #35 no longer showed any evidence of total coliforms. However, the remaining four stations still showed positive levels for total coliforms. These were: Sample #31 (1 sample out of four was positive; 2/100 ml); Sample #34 (4 samples out of four positive; 1/100 ml); Sample #36 (1 sample out of 4 positive, 1/100 ml); and Sample #42 (1 sample out of 4 positive, 1/100 ml).

Sample #31 was the only home supplied by Well #2 (chlorinated) which tested positive for total coliforms (1/100 ml) at the initial sampling in October; see Table 18)). When resampled in January, 1995, one of four repeat samples of the Station #31 household again tested positive for total coliforms, as described above. Although a "trace" (<0.1 mg/l) of free chlorine was detected in Sample #31, this home is apparently located at the end of the distribution system. Consequently, it appears likely that the design of the treatment system may be unable to maintain an adequate level of disinfection at this point in the distribution system. Ideally, most chlorinated systems should be designed to maintain at least a 0.2 mg/l residual of free chlorine throughout the system.

The remaining two initially total coliform positive samples on Shoalwater Bay property consisted of two buildings, identified as Sample Stations #35 and #36 (Table 18, Figure 6), which are supplied by a single, separate well. This source appears to be unchlorinated, since chlorine residuals from both buildings were not detected (<0.1 mg/l). Both collection stations tested positive at initial sampling for total coliforms at low levels but were negative for fecal coliforms

and *E. coli*. Repeat sampling in January from both of these locations confirmed that bacterial contamination was still present at Sample Station #36 but not at Station #35.

Eight of the thirty six collection stations were located off the Reservation; in various of the neighboring areas of Westport, Grayland, Ocosta, and South Bend. Of these, two tested positive for total coliforms, in both the initial sampling and the repeat sampling three months later. Sample #34 was a residence in Grayland which receives water from the Grayland water utility. Sample #42 was a residence in Ocosta which receives water from a private well. Neither station had detectable chlorine residuals, or an outside sampling point. As discussed previously, respective samples for microbiology were thus necessarily collected from the laundry room sink faucet (for Sample #34; Grayland) and from the bathroom sink faucet (for Sample # 42; Ocosta). Since indoor faucets and sinks are often contaminated by various indoor human activities, sampling from these locations is discouraged unless no other outside sources can be found. It thus would appear highly likely that the total coliforms contamination found at both stations, at both initial and repeat sampling times, is a direct consequence of having to obtain both samples from an indoor tap.

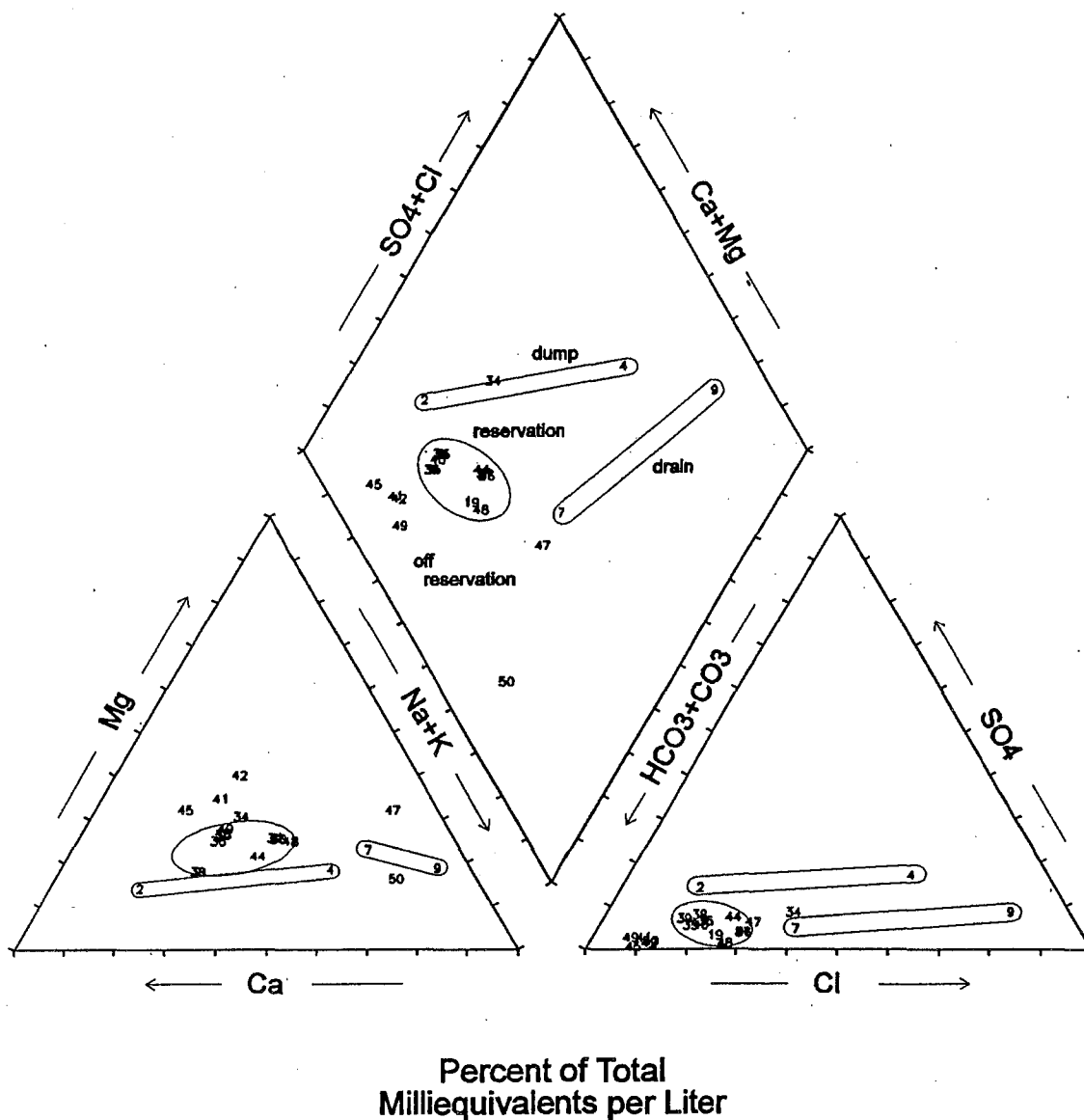


Figure 9. Water types differentiated by major cations and anions. Reservation drinking water is clustered in the subcircular area. Surface water from the dump site and cranberry drainage ditch is shown in the oblong areas.

Chapter 7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

EPA's examination of four major environmental exposure pathways in the vicinity of the Shoalwater Bay Tribe, utilizing relatively few samples, can not provide absolute answers about whether environmental contaminants are in fact contributing to the recently documented Tribal health problems. However, evidence generated by the present study would make this possibility seem quite unlikely.

Two other important environmental exposure pathways for the Shoalwater Bay area, air and ground water, were not examined in this report. For reasons described below, their possible impacts on the Willapa ecosystem should be explored further.

Conclusions from this investigation of the four exposure pathways can be summarized as follows:

7.1.1 Dump Site

From the results of this preliminary screening investigation, it does not appear that the waste stream from the abandoned dump site near the Shoalwater Bay Indian Reservation poses a significant health or environmental risk.

7.1.2 Tidelats

The limited data from this study show the Willapa sediment samples to be relatively clean and well within normal background for contaminants normally associated with such areas. However, certain tidelats-related contaminant issues merit further consideration:

- **Mercury and Methyl mercury**

Methyl mercury is the most important form of mercury in terms of toxicity, especially to the fetus of mothers exposed to methyl mercury during pregnancy (68). In the aquatic environment, virtually any mercurial compound may be changed to methyl mercury by microbial activity (84). Accordingly, it is also the mercury species of special concern in any aquatic ecosystem where disposal of mercury wastes has occurred.

In this study, the laboratory techniques utilized could not detect methylmercury and other organomercury compounds in the sediment samples at sufficiently low levels to draw direct conclusions about their presence or effect. However, the average concentration of total mercury in the earth's crust is estimated by Jonasson (1970) at 0.080 mg/kg (85). For all seven tidelats sediment samples, our analytical capabilities for detecting total mercury were in all cases at least 0.05 mg/kg (50 µg/kg; 50 ppb) or lower. In two samples, the levels for total mercury were higher, resulting in the two positive measurements of 0.0222 mg/kg (Sample #12A; Table 11) and

0.0445 mg/kg (Sample #23). Although we could not specifically measure methyl mercury in this study, the relatively low levels for total mercury in the two positive sediments, plus our generally low MDLs for total mercury in the remaining sediments provide very strong assurance that methyl mercury is not a likely problem in this immediate ecosystem.

- **Novel Halogenated Compounds in Sediment**

The presence of the bromo- and iodo- compounds with instrumental responses identical to bromoxynil and ioxynil at relatively uniform levels throughout the estuary was unanticipated but not particularly surprising. Seawater contains a multitude of bromo- and iodo- compounds (54),(55). However, the presence of these compounds in the dump drainage was unexpected. From the evidence at hand, it appears that these two materials are marine natural products. It is unlikely that they represent xenobiotic compounds, hazardous waste, or similar materials intentionally added to the Willapa Bay ecosystem. However, because they were found in the dump site sediment and because the structure of these compounds appears to be very similar to two herbicide compounds, further research is needed to identify and characterize them.

- **Carbaryl and Glyphosate**

Carbaryl and glyphosate are sprayed on the tideflats to (respectively) eradicate ghost shrimp and *Spartina* sea grass. Carbaryl is not a persistent pesticide, and is degraded via both photolysis and microbial activity in sediments and water, especially under conditions of basic pH (86),(87),(88). However, until breakdown occurs and flushing and other natural processes can replenish the normal intertidal fauna, the spraying is acutely lethal to virtually all invertebrates, nekton and plankton living in or passing through the immediate spray zones. This includes crab zoea, larval fishes, and other critical life stages of various key resources in the Bay. Although much less acutely toxic to nontarget species than carbaryl, glyphosate is often used in concert with various surfactants, which have high aquatic toxicities. While neither of these compounds was detected in the sediment samples collected for this study, the timing of field sampling events precluded the collection of tideflat samples at appropriate timeframes immediately following any scheduled chemical application episodes.

7.1.3 Cranberry Bog Drainage

This exposure pathway is an obvious problem within the general Willapa Bay ecosystem. Several pesticide residues detected in the runoff from this area are sufficiently high to be in violation of federal and state water quality standards. The theoretical risk from such organophosphates as azinphos-methyl is considerable, not only to nontarget organisms but possibly to humans or animals who might swim in the ditch, or drink surface water in the immediate area during periods of application in the upstream bogs. Residues of the less toxic but more persistent organophosphate, *chlorpyrifos*, are also an apparent problem in the pesticide drainage ditch. Exposure of organisms to mixtures of various pesticide residues in the runoff is also an issue which merits further assessment.

Pesticide runoff from farming areas raises other concerns beyond the scope of this study such as contaminated sediment fate and transport, the long term impact of pesticide laden water runoff

and sediment deposition on tidelands, and whether vulnerable ground water resources are being impacted.

7.1.4 Drinking Water

- **Lead**

From the results of this examination of household taps, lead in drinking water is not a problem for the Reservation and associated areas at this time. "First-pour" water samples in indoor household taps show a slight elevation for lead compared to samples taken after periods of normal flow, a typical response for older plumbing systems. However, in no case was a violation of the EPA lead action level of 0.015 mg/l observed.

- **Organics**

Although the current investigation did not analyze for pesticides and other organics in Tribal household drinking water systems, a 1993 EPA analysis of a single sample from the main wellhead (EPA, 1993) for organics was unremarkable (9),(10),(11).

- **Microbiology**

Low levels of total coliforms were found at five of 36 stations. Of the five stations found positive for total coliforms, three were on the Shoalwater Bay Reservation, one was in the neighboring Ocosta area, and one was in Grayland. The presence of consistently low numbers of total coliforms, in the absence of fecal coliforms, indicates an outside contamination source, either in the distribution system or the wellhead. The lack of fecal coliforms indicates that the source of contamination is not from fresh fecal contamination, but may be from soil contamination entering the distribution system of the well through infiltration or fractures. All five stations also had trace or no detectable levels of chlorine. Based on the chlorine and coliform test results, the Reservation-West and Dexter areas have insufficient chlorination to treat the bacteria in the systems.

Station #34 (Grayland) was repeatedly positive for total coliforms (4/4; Table 18). If follow up drinking water samples from this suspect station continue to show positive total coliforms, with negative results from other stations in the distribution system, then it is likely that the contamination is the result of a domestic or other non-distribution system plumbing problem.

7.1.5 Livestock Dipping Station

Preliminary analyses by the EPA Region 10 Superfund program, of ground water underlying the former livestock dipping station appear unremarkable (58), (59), in spite of the chemical contamination in the overlying soil. However, additional testing of ground water, for a greater variety of residues and at lower detection levels, is clearly warranted.

Soil exceedances of EPA risk-based concentrations for several persistent organochlorine pesticides were noted for the former dip site, in seven of the various soil samples ranging from the surface down to a depth of six feet. Therefore, the EPA Region 10 Superfund Technical

Assessment and Response Team has recommended a removal action for the contaminated site. Based on currently available information, this would involve the removal of approximately 555 cubic yards of pesticide-contaminated soils, 2000 gallons of pesticide-contaminated water inside the cattle dipping tank, and the potentially pesticide-contaminated debris associated with the corral and the dipping tank. (59)

7.2 RECOMMENDATIONS FOR FUTURE RESEARCH

It should be emphasized that the various environmental exposure pathways at Willapa Bay impact not just the Shoalwater Bay Indian Tribe, but the entire Willapa Bay ecosystem. It is important that this ecosystem be recognized and treated as a complex and unique area, rich in natural resources but beset with increasing conflict about land use planning and natural resource utilization.

The movement or drift of pesticides beyond the boundaries of the targeted application, is a universal concern in areas where competing land use practices and natural resource utilization frequently intersect. It is an issue of central importance to the highly productive Willapa Bay ecosystem, where pesticides are applied not only to surface water and to soil, but also via aircraft to selected tidelands.

In this limited assessment, two important exposure pathways, Air and Ground Water, were not examined. Because of the nature of the Shoalwater Bay - Willapa Bay ecosystem and the likelihood of transboundary migration of xenobiotic contaminants into these two environmental media, both pathways should receive further scrutiny.

With these general issues in mind, EPA suggests the following areas for future environmental research:

- **Ground Water**

- ✓ Vulnerable ground water resources underlying areas of application and pesticide runoff from cranberry bogs should be screened for pesticides and organics.

- **Air**

Air is a Shoalwater-Willapa exposure pathway that has not been explored. For most of the year, the airshed over Willapa Bay appears to be relatively pristine, free from major inversions and urban pollutant sources. Although the Reservation and surrounding areas are very rural, spraying in the tideflats, cranberry fields and possibly locations near the Reservation may be creating some exposures.

Inhalation Exposures: A lingering and complex issue for the Shoalwater Bay area and other parts of greater Willapa Bay is the aerial spraying of carbaryl on adjacent tidelands during summer months, to facilitate the commercial propagation of shellfish. The inhalation exposure to Tribal members and other residents of living around the Bay during pesticide/herbicide application events is unknown.

- ✓ Some limited air monitoring of likely worse-case areas is recommended during aerial pesticide application events.

Air / Tideland Interface: Carbaryl and Other Pesticides (Ecological Effects):

The air pathway not only poses the risk of episodes of acute inhalation and dermal exposure of humans, birds and other terrestrial life to ambient concentrations of carbaryl in the area, but it also interfaces directly with the intertidal zone, the prime target of the spraying.

- ✓ We recommend further studies of the long term ecological impact of carbaryl on nontarget aquatic organisms in the area.
- ✓ To break the pattern of persistent stressing of micro communities within the estuary, State and federal agencies and extension scientists should work with shellfish farmers to develop less draconian methods of controlling mud shrimp populations.

- **Tideflats**

Novel Halogenated Compounds (sediment): Because the unusual bromo- and iodo-compounds were found in the dump site sediments outside the immediate influence of the marine environment and because they so closely resemble two known herbicides, additional investigation would allow a better understanding of the source, fate and impact of these compounds.

- ✓ It is strongly recommended that further research be directed to the occurrence of these novel compounds, to elucidate their structures, sources, function and potential impact.

Methyl mercury (sediment): Total mercury results were not elevated above background in any of the seven sediment samples, suggesting that highly toxic organomercurials are not an issue of concern in the general Shoalwater Bay marine ecosystem. However, SQLs for methyl mercury were insufficient to obtain specific information about levels of this toxic compound.

- ✓ To more fully augment and strengthen the database for organomercury compounds in Bay sediment for this area, additional Willapa Bay sediment samples should be obtained and analyzed for organomercury.

Carbaryl and Glyphosate (sediment /biota):

- ✓ Sediment samples should be collected reasonably adjacent to the application areas immediately after spraying to determine if short-term sediment loading is occurring.
- ✓ The general use of such intentionally applied pesticides in the Willapa ecosystem, should be examined closely for possible nontarget effects (see Air).

- **Cranberry Bog Pesticides**

Pesticide Fate and Transport Via Sediment: Data from only two sampling stations did not provide enough information to assess the loading of pesticides in sediment, and where the sediment goes.

- ✓ A more extensive study of the entire cranberry drainage is necessary to determine the extent of sediment contamination and the destination of contaminated sediment.

Aquatic Bioassays:

- ✓ In-stream monitoring, especially via aquatic bioassays, should be performed to determine the cumulative effects of the use of different pesticides and herbicides in the cranberry growing area.

Tissue: While sediment and water residue chemistry did not suggest major problems, no tissue samples were collected for the purpose of determining tissue loading or bioconcentration of the chemicals of concern.

- ✓ Inasmuch as bioconcentration mechanisms are not fully understood, selective analysis of some sustenance organisms, particularly those impacted by the exposure to cranberry runoff, might be revealing.

Livestock Dipping Station

Because of the urgent need for new Tribal housing on the Reservation, it is strongly recommended that EPA Superfund proceed swiftly to ensure that the proposed soil removal and remediation at the former livestock dipping site take place as soon as possible. This process should also include appropriate human health risk and exposure assessments following the cleanup, to ensure that the site is suitable for public housing, particularly for occupancy by children, pregnant women and similar high-risk groups.

7.3 RECOMMENDATIONS FOR FUTURE MANAGEMENT PRACTICES AND TECHNICAL INVESTIGATIONS

- **Drinking Water**

Lead: The data indicate that flushing household taps prior to using the water for drinking or cooking is an effective method to reduce lead concentrations.

- ✓ Educational efforts should be undertaken to encourage this practice.

Microbiology: Since the EPA Total Coliform Rule is based on a presence /absence concept, a drinking water system positive for coliforms remains in non-compliance regardless of the numbers of coliform present. Continued monitoring of microbiological contaminants should probably be performed in certain areas.

- ✓ Assuming that the two off-Reservation (#34 and #42) stations were total coliforms positive due to the poor collection points (circumstances necessitating the collection of samples from taps inside the home, rather than outside), these homes should be further studied to insure positive results were the consequence of a poor collection point and not because of contaminated drinking water. The three Reservation collection points (Stations #31, #35, and #36) that tested positive at outside taps are of more concern.
- ✓ It is recommended that the Grayland total coliforms positive station located off SR 105 (Sample #34) be incorporated into the local utility's monthly drinking water monitoring program.
- ✓ Further evaluation of the private well located in Ocosta (Sample #42) should include additional testing. If additional samples collected at various points throughout this private system continue to be positive for total coliforms, an on-site evaluation of the system starting at the well head and storage tank should be performed.
- ✓ If future ground water contamination by pesticides is indicated or predicted by future studies, it is recommended that a program of episodic testing of main drinking water wellhead(s) for organics and pesticide residues be implemented.

- **Tideflats**

Tideflats Microbiology (shellfish/seawater): Fecal contamination in nearshore seawater may be indicative of failing septic systems in the area. Fecal contamination was noted in the station selected north of the swimming hole. While not violating any health based standards, elevated levels of both *E. coli* and fecal coliform were also found in razor clams. Eating food taken from or swimming in water contaminated with *E. coli* or fecal material could cause serious illness.

- ✓ The septic systems in affected areas should be evaluated further using a dye-tracing method accompanied by concurrent fecal coliforms sampling (89). Those systems suspected of failure should be repaired or replaced.
- ✓ Since a GM is used in establishing the extent of bacterial contamination of registered shellfish beds, a single sampling point is insufficient to determine the quality of overlying water or shellfish. Further testing of the overlying seawaters and shellfish is required to more fully evaluate the microbial safety of the shellfish.

Cranberry Bog Pesticides

Best Management Practices (BMPs):

- ✓ BMPs should be developed which limit and minimize the use of highly toxic, broad spectrum pesticides such as guthion and chlorpyrifos.
- ✓ Agencies responsible for pesticide registration (USEPA, Washington State Department of Agriculture) should work closely with appropriate federal, state and local water quality agencies (Washington State Department of Ecology (WDOE), EPA ORD, wetland researchers, etc.), and with growers and other appropriate parties, in revising and improving the process of selecting pesticides to be used in this complex aquatic ecosystem.

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APPENDICES

Appendix A: SHOALWATER BAY HEALTH CONCERNS ADVISORY COMMITTEE

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(Secretary-Treasurer) Carol Sycks, P.O. Box 203, Lebam, WA 98554.

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Appendix C: COMPOUNDS WHICH WERE NOT DETECTED IN SHOALWATER BAY SAMPLES

Table C-1. Inorganic Compounds Which Were Not Detected in Dump Site Samples

Table C-2. Pesticides Which Were Not Detected in Dump Site Samples

Table C-3. Semi-Volatiles Which Were Not Detected in Dump Site Samples

Table C-4. Volatiles Which Were Not Detected in Dump Site Samples

Table C-5. Metals and Pesticides Which Were Not Detected in Cranberry Bog Samples

Table C-6. Metals and Pesticides Which Were Not Detected in Tideflat Samples

Table C-1. Inorganic Compounds Which Were Not Detected in Dump Site Samples

Station Number	CAS Number	1	2	3	4	5					
Location		Dump Site	Dump Site, Leachate	FW Stream, Below Dump Site	FW Stream, Below Dump Site	Estuary, Upper Beach Lagoon					
EPA Sample Number		95080025	95080026	95080023	95080024	95080021					
Media		Sediment	Water	Sediment	Water	Sediment					
Metals Measurements											
		mg/kg		µg/L		mg/kg		µg/l		mg/kg	
Selenium	7782492	0.8	U	2	U	0.8	U	2	U	0.8	U
Thallium	7440280	0.5	U	1	U	0.5	U	1	U	0.5	U
Antimony	7440360	40	UN	0.5	U	4	UN	0.5	U	4	UN
Silver	7440224			0.1	UN			0.1	UN		

Table C-2. Pesticides Which Were Not Detected in Dump Site Samples. (Page 1 of 4)

Station Number	CAS Number	1		2		3		4		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080024		95080021	
Media		Sediment		Water		Sediment		Water		Sediment	
		µg/kg		µg/L		µg/kg		µg/L		µg/kg	
1-Naphthol	90153	9.3	U	0.5	U	4.1	U	0.5	U	6.3	U
1,3-Dinitrobenzene	99650	1736.0	U	2.0	U	405.5	U	2.0	U	480.8	U
2-Nitrotoluene	88722	520.8	U	2.0	U	243.3	U	2.0	U	288.5	U
2,4-D	94757	128.0	U	0.2	U	62.0	U	0.2	U	136.0	U
2,4-DB	94826	155.0	U	0.2	U	75.0	U	0.2	U	164.0	U
2,4-Dinitrotoluene	121142	520.8	U	2.0	U	243.3	U	2.0	U	288.5	U
2,4,5-T	93765	102.0	U	0.1	U	49.0	U	0.1	U	108.0	U
2,4,5-TB	93801	116.0	U	0.1	U	56.0	U	0.1	U	123.0	U
2,4,5-Trichlorophenol	95954	74.0	U	0.1	U	36.0	U	0.1	U	79.0	U
2,4,6-Trichlorophenol	88062	75.0	U	0.1	U	36.0	U	0.1	U	80.0	U
2,6-Dinitrotoluene	606202	520.8	U	2.0	U	243.3	U	2.0	U	288.5	U
3,5-Dichlorobenzoic acid	51365	125.0	U	0.2	U	60.0	U	0.2	U	133.0	U
4-Nitrotoluene	99990	520.8	U	2.0	U	243.3	U	2.0	U	288.5	U
5-Hydroxydicamba	7600502	128.0	U	0.2	U	61.0	U	0.2	U	135.0	U
Abate (Temephos)	3383968	886.0	UJ	1.0	UJ	381.0	UJ	0.1	UJ	575.0	UJ
Alachlor	15972608	354.0	U	0.3	U	152.0	U	0.3	U	230.0	U
Aldicarb	116063			0.5	U			0.5	U		
Aldicarb Sulfone	1646884			0.5	U			0.5	U		
Aldicarb sulfoxide	1646873			0.5	U			0.5	U		
Aldrin	309002	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Alpha-BHC	319846	29.0	U	0.0	U	12.0	U	0.0	U		
Ametryn	834128	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Atraton	1610179	295.0	U	0.3	U	127.0	U	0.3	U	192.0	U
Atrazine	19312249	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Azinphos-ethyl	2642719	157.0	UJ	0.1	U	68.0	UJ	0.1	U	102.0	UJ
Azinphos-methyl	86500	157.0	UJ	0.1	U	68.0	UJ	0.1	U	102.0	UJ
BDMC	300050		NAR		NAR		NAR		NAR		NAR
Benefin	1861401	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Bentazon	25057890	192.0	U	0.2	U	92.0	U	0.2	U	203.0	U
Benzene, 1-methyl-3-nitr	99081	520.8	U	2.0	U	243.3	U	2.0	U	288.5	U
Benzene, 1,2,3,5-tetrach	877098		NAR		NAR		NAR		NAR		NAR
Benzene, Trinitro-	99354	2603.9	U	2.0	U	405.5	U	2.0	U	480.8	U
Benzene, 2-methyl-1,3,5-trinitro-	118967	868.0	U	2.0	U	405.5	U	2.0	U	480.8	U
Benzonitrile, 2,6-dichlo	1194656	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Beta-BHC	319857	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Bromacil	314409	394.0	U	0.4	U	169.0	U	0.4	U	255.0	U
4-Hydroxy-3,5-dibromobenzonit rile	1689845	129.0	U	0.2	U	62.0	U	0.2	U	136.0	U
Butachlor	23184669	344.0	U	0.3	U	148.0	U	0.3	U	224.0	U
Butylate	2008415	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Butyltin trichloride	1118463	22.5	U			11.0	UJ			23.8	U
Carbaryl	63252	4.7	U	0.5	U	2.1	U	0.5	U	3.1	U

Station Number	CAS Number	1		2		3		4		5	
Carbophenothion	786196	98.0	U	0.1	UJ	42.0	U	0.1	UJ	64.0	U
Carboxin	5234685	1083.0	U	1.0	U	465.0	U	1.0	U	703.0	U
Chlordane (Tech)	57749	381.0	U	0.4	U	499.0	U	0.4	U	257.0	U
Chlorpropham (CIPC)	101213	394.0	U	0.4	U	169.0	U	0.4	U	255.0	U
Chlorpyrifos-ethyl	5598130	79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
Coumaphos	56724	118.0	UJ	0.1	UJ	51.0	UJ	0.1	UJ	77.0	UJ
Cyanazine	21725462	148.0	UJ	0.1	UJ	63.0	UJ	0.1	U	96.0	UJ
Cycloate	1134232	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Daconil	1897456	236.0	U	0.2	U	102.0	U	0.2	U	153.0	U
Dalapon	75990	87.0	U	0.1	U	42.0	U	0.1	U	92.0	U
DCPA (dacthal)	18611321	99.0	U	0.1	U	48.0	U	0.1	U	105.0	U
DEF	78488	138.0	U	0.1	U	59.0	U	0.1	U	89.0	U
Delta-BHC	319868	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Demeton-0	298033	138.0	UJ	0.1	UJ	59.0	UJ	0.1	UJ	89.0	UJ
Demeton-s	126750	138.0	UJ	0.1	UJ	59.0	UJ	0.1	UJ	89.0	UJ
Diallate	2303164	374.0	U	0.3	U	161.0	U	0.3	U	243.0	U
Diazinon	333415	79.0	UJ	0.1	U	34.0	UJ	0.1	U	51.0	UJ
Dibutylchlorendate	1770805		NAR		NAR		NAR		NAR		NAR
Dibutyltin dichloride	683181	22.5	UJ			11.0	UJ			24.0	U
Dicamba	1918009	127.0	U	0.2	U	61.0	U	0.2	U	135.0	U
Dichlorprop	120365	140.0	U	0.2	U	68.0	U	0.2	U	149.0	U
Dichlorvos	62737	79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
Diclofop-methyl	51338273	203.0	UJ	0.2	U	98.0	UJ	0.3	U	215.0	UJ
Dieldrin	60571	57.0	U	0.1	U	25.0	U	0.1	U	39.0	U
Dimethoate	60515	79.0	UJ	0.1	UJ	34.0	UJ	0.1	UJ	51.0	UJ
Dioxathion	78342	167.0	UJ	0.2	U	72.0	UJ	0.2	U	109.0	UJ
Diphenamid	957517	295.0	U	0.3	U	127.0	U	0.3	U	192.0	U
Disulfoton	298044	59.0	UJ	0.1	UJ	25.0	UJ	0.1	UJ	38.0	UJ
Diuron	330541	591.0	UJ	1.0	UJ	254.0	UJ	1.0	UJ	383.0	UJ
Endosulfan I	959988	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Endosulfan II	33213659	57.0	U	0.1	U	25.0	U	0.1	U	39.0	U
Endrin	72208	57.0	U	0.1	U	25.0	U	0.1	U	39.0	U
Endrin Aldehyde	7421934	57.0	U	0.1	U	25.0	U	0.1	U	39.0	UJ
EPN	2104645	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Eptam	759944	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Ethalfuralin (Sonalan)	55283686	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Ethion	563122	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U
Ethoprop	13194484	79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
Fenamiphos	22224926	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Fenarimol	60168889	295.0	U	0.3	U	127.0	U	0.3	U	192.0	U
Fenithrothion	122145	69.0	U	0.1	UJ	30.0	U	0.1	UJ	45.0	U
Fensulfthion	115902	157.0	U	0.1	UJ	68.0	U	0.1	UJ	102.0	U
Fenthion	55389	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U
Fluridone	59756604	591.0	UJ	1.0	UJ	254.0	UJ	1.0	UJ	383.0	UJ
Fonophos	944229	59.0	U	0.1	U	25.0	U	0.1	U	38.0	U
Heptachlor	76448	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Heptachlor Epoxide	1024573	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Hexazinone	51235042	148.0	UJ	0.1	UJ	63.0	UJ	0.1	UJ	96.0	UJ
Imidan	732116	108.0	UJ	0.1	U	47.0	UJ	0.1	U	70.0	UJ
4-Hydroxy-3,5-diiodobenzonitrile	1689834	133.0	UJ	0.2	U	64.0	UJ	0.2	U	141.0	UJ

Station Number	CAS Number	1		2		3		4		5	
Lindane	58899	29.0	U	0.0	U	12.0	U	0.0	U	19.0	U
Malathion E50	121755	79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
MCPA	94746	253.0	U	0.3	U	122.0	U	0.3	U	268.0	U
MCPP	93652	259.0	U	0.3	U	125.0	U	0.3	U	275.0	U
Mercury Methyl	115093	2.7	UJ			5.8	UJ			2.1	UJ
Merphos	150505	118.0	UJ	0.1	U	51.0	UJ	0.1	U	77.0	UJ
Metalaxyl	57837191	669.0	U	1.0	U	288.0	U	1.0	UJ	434.0	U
Metholachlor	51218452	394.0	U	0.4	U	169.0	U	0.4	U	255.0	U
Methomyl	16752775			0.5	U			0.5	U		
Methoxychlor	72435	57.0	UJ	0.1	U	166.0	U	0.1	U	39.0	UJ
Methyl Chlorpyrifos		79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
Methyl Paraoxon		177.0	U	0.2	U	76.0	U	0.2	U	115.0	U
Metribuzin	21087649	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Mevinphos	7786347	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
MGK-264	113484	689.0	U	1.0	U	296.0	U	1.0	U	447.0	U
Molinate	2212671	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Monocrotophos	6923224	689.0	UJ	0.6	UJ	296.0	UJ	0.6	UJ	447.0	UJ
Napropamide	15299997	295.0	U	0.3	U	127.0	U	0.3	U	192.0	U
Nitrobenzene	98953	868.0	U		NAR	405.5	U		NAR	480.8	U
Norflurazon	27314132	197.0	UJ	0.2	UJ	85.0	UJ	0.2	UJ	128.0	UJ
Oxyfluorfen	42874033	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Parathion	56382	79.0	U	0.1	U	34.0	U	0.1	U	51.0	U
Parathion-methyl	298000	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U
PCB-1016	12674112	381.0	U	0.4	U	166.0	U	0.4	U	257.0	U
PCB-1221	11104282	381.0	U	0.4	U	333.0	U	0.4	U	257.0	U
PCB-1232	11141165	762.0	U	0.7	U	166.0	U	0.7	U	515.0	U
PCB-1242	53469219	381.0	U	0.4	U	166.0	U	0.4	U	257.0	U
PCB-1248	12672296	381.0	U	0.4	U	166.0	U	0.4	U	257.0	U
PCB-1254	11097691	381.0	U	0.4	U	166.0	U	0.4	U	257.0	U
PCB-1260	11096825	381.0	U	0.4	U	166.0	U	0.4	U	257.0	U
Pebulate	1114712	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Pendimethalin	40487421	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Phenol, 2,3,4,5-tetrachl	4901513	70.0	U	0.1	U	34.0	U	0.1	U	74.0	U
Phenol, 2,3,4,6-tetrachl	58902	70.0	U	0.1	U	34.0	U	0.1	U	74.0	U
Phorate	298022	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U
Phosphamidan	297994	236.0	UJ	0.2	U	102.0	UJ	0.2	U	153.0	UJ
Picloram	1918021	129.0	UJ	0.2	U	62.0	UJ	0.2	U	137.0	UJ
Profluralin	26399360	236.0	U	0.2	U	102.0	U	0.2	U	153.0	U
Prometon	1610180	98.0	UJ	0.1	UJ	42.0	UJ	0.1	UJ	64.0	UJ
Prometryne	7287196	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Pronamide (kerb)	23950585	394.0	U	0.4	U	169.0	U	0.4	U	255.0	U
Propazine	139402	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Propetamphos	31218834	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Propoxur	114261	4.7	U	0.5	U	2.1	U	0.5	U	3.1	U
Ramrod	1918167	236.0	U	0.2	U	102.0	U	0.2	U	153.0	U
Ronnel	299843	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U
Silvex	93721	102.0	U	0.1	U	49.0	U	0.1	U	108.0	U
Simazine	122349	98.0	UJ	0.1	UJ	42.0	UJ	0.1	UJ	64.0	UJ
Sulfotep	3689245	59.0	U	0.1	U	25.0	U	0.1	U	38.0	U
Sulprofos	35400432	69.0	U	0.1	U	30.0	U	0.1	U	45.0	U

Station Number	CAS Number	1		2		3		4		5	
Tebuthiuron	34014181	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Terbacil	5902512	295.0	U	0.3	U	127.0	U	0.3	U	192.0	U
Terbutryn (Igran)	886500	98.0	U	0.1	U	42.0	U	0.1	U	64.0	U
Tetrabutyltin	1461252	23.7	U			11.4	UJ			25.0	U
Tetrachlorvinphos	961115	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Tetryl	479458	868.0	U	2.0	U	405.5	U	2.0	U	480.8	U
Triademefon	43121433	256.0	U	0.2	U	110.0	U	0.2	U	166.0	U
Tributyltin chloride	1461229	20.5	UJ			10.6	UJ			25.7	U
Trichlopyr	55335063	102.0	U	0.1	U	49.0	U	0.1	U	109.0	U
Trifluraline	1582098	148.0	U	0.1	U	63.0	U	0.1	U	96.0	U
Vernolate	1929777	197.0	U	0.2	U	85.0	U	0.2	U	128.0	U
Vydate	23135220			0.5	U			0.5	U		

Table C-3. Semi-Volatiles Which Were Not Detected in Dump Site Samples

Station Number	CAS Number	1		2		3		4		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080024		95080021	
Media		Sediment		Water		Sediment		Water		Sediment	
		µg/kg		µg/l		µg/kg		µg/l		µg/kg	
1,2-Dichlorobenzene	95501	152	U	0.28	U	66.6	U	0.28	U	103	U
1,2-Diphenylhydrazine	122667	152	U	0.28	U	66.6	U	0.28	U	103	U
1,2,4-Trichlorobenzene	120821	152	U	0.28	U	66.6	U	0.28	U	103	U
1,3-Dichlorobenzene	541731	152	U	0.28	U	66.6	U	0.28	U	103	U
1,4-Dichlorobenzene	106467	152	U	0.28	U	66.6	U	0.28	U	103	U
2-Chloronaphthalene	91587	152	U	0.28	U	66.6	U	0.28	U	103	U
2-Chlorophenol	95578	152	U	0.28	U	66.6	U	0.28	U	103	U
2-Methylphenol	95487	152	U	0.28	U	66.6	U	0.28	U	103	U
2-Nitroaniline	88744	762	U	2.8	U	333	U	2.8	U	515	U
2-Nitrophenol	88755	762	U	0.57	U	333	U	0.57	U	515	U
2,4-Dichlorophenol	120832	152	U	0.28	U	66.6	U	0.28	U	103	U
2,4-Dimethylphenol	105679	152	U	0.28	U	66.6	U	0.28	U	103	U
2,4-Dinitrophenol	51285	6090	UJ	5.7	U	2660	UJ	5.7	U	4120	UJ
2,4-Dinitrotoluene	121142	1520	U	2.8	U	666	U	2.8	U	1030	U
2,4,5-Trichlorophenol	95954	152	U	0.28	U	66.6	U	0.28	U	103	U
2,4,6-Trichlorophenol	88062	305	U	0.28	U	133	U	0.28	U	206	U
2,6-Dinitrotoluene	606202	762	U	2.8	U	333	U	2.8	U	515	U
3,3'-Dichlorobenzidine	91941	305	U	0.57	U	133	U	0.57	U	206	U
3-Nitroaniline	99092	762	U	1.4	U	333	U	1.4	U	515	U
3B-Coprostanol	360689		R	2.8	U		R	2.8	U		R
4-Bromophenyl-Phenylether	101553	152	U	0.28	U	66.6	U	0.28	U	103	U
4-Chloro-3-methylphenol	59507	152	U	0.28	U	66.6	U	0.28	U	103	U
4-Chloroaniline	106478	152	U	0.28	U	66.6	U	0.28	U	103	U
4-Chlorophenyl-Phenylether	7005723	152	U	0.28	U	66.6	U	0.28	U	103	U
4-Nitroaniline	100016	762	U	0.57	U	333	U	0.57	U	515	U
4-Nitrophenol	100027	1520	U	2.8	U	666	U	2.8	U	1030	U
4,6-Dinitro-2-methylphenol	534521	3050	U	5.7	U	1330	U	5.7	U	2060	U
9H-Carbazole	86748	152	U	0.28	U	66.6	U	0.28	U	103	U
Acenaphthylene	208968	152	U	0.28	U	66.6	U	0.28	U	103	U
Aniline	62533	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzidine	92875	305	UJ	0.57	U	133	UJ	0.57	U	206	UJ
Benzo [b] fluoranthene	205992	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzo(a)anthracene	56553	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzo(a)pyrene	50328	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzo(g,h,i)perylene	191242	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzoic acid	65850	3050	U	5.7	UJ	1330	U	5.7	U	2060	U
Benzo[k]fluoranthene	207089	152	U	0.28	U	66.6	U	0.28	U	103	U
Benzyl alcohol	100516	152	U	0.28	U	66.6	U	0.28	U	103	U

Station Number	CAS Number	1		2		3		4		5	
bis(2-Chloroethoxy)methane	111911	152	U	0.28	U	66.6	U	0.28	U	103	U
bis(2-Chloroethyl)ether	111444	152	U	0.28	U	66.6	U	0.28	U	103	U
bis(2-Chloroisopropyl)ether	39638329	152	U	0.28	U	66.6	U	0.28	U	103	U
Bis(2-ethylhexyl) phthal	117817	880	U	0.28	U	1330	U	0.28	U	515	U
Butylbenzylphthalate	85687	762	U	0.28	U	333	U	0.28	U	515	U
Caffeine	58082	152	U	0.28	U	66.6	U	0.28	U	103	U
Chrysene	218019	152	U	0.28	U	66.6	U	0.28	U	103	U
Di-n-octylphthalate	117840	762	U	1.4	U	333	U	1.4	U	515	U
Dibenz[a,h]anthracene	53703	152	U	0.28	U	66.6	U	0.28	U	103	U
Dimethylphthalate	131113	152	U	0.28	U	66.6	U	0.28	U	103	U
Hexachlorobenzene	118741	152	U	0.28	U	66.6	U	0.28	U	103	U
Hexachlorobutadiene	87683	152	U	0.28	U	66.6	U	0.28	U	103	U
Hexachlorocyclopentadiene	77474	3050	U	1.4	U	1330	U	1.4	U	2060	U
Hexachloroethane	67721	152	U	0.28	U	66.6	U	0.28	U	103	U
Indeno(1,2,3-cd)pyrene	193395	152	U	0.28	U	66.6	U	0.28	U	103	U
Isophorone	78591	152	U	0.28	U	66.6	U	0.28	U	103	U
n-Nitrosodiphenylamine	86306	152	U	0.28	U	66.6	U	0.28	U	103	U
n-Nitrosodimethylamine	62759	762	U	0.28	U	333	U	0.28	U	515	U
N-Nitrosodinpropylamine	621647	152	U	0.28	U	66.6	U	0.28	U	103	U
Naphthalene, 2-methyl-	91576	152	U	0.28	U	66.6	U	0.28	U	103	U
Naphthalene	91203	152	U	0.28	U	66.6	U	0.28	U	103	U
Nitrobenzene	98953	152	U	0.28	U	66.6	U	0.28	U	103	U
Pentachlorophenol	87865	1520	U	2.8	U	666	U	2.8	U	1030	U
Phenanthrene	85018	152	U	0.28	U	66.6	U	0.28	U	103	U
Phenol	108952	152	U	0.28	U	66.6	U	0.28	U	232	U
Pyridine	110861	305	U	0.28	U	133	U	0.28	U	206	U

Table C-4. Volatiles Which Were Not Detected in Dump Site Samples

Station Number	CAS Number	1		2		3		4		5	
Location		Dump Site		Dump Site, Leachate		FW Stream, Below Dump Site		FW Stream, Below Dump Site		Estuary, Upper Beach Lagoon	
EPA Sample Number		95080025		95080026		95080023		95080024		95080021	
Media		Sediment		Water		Sediment		Water		Sediment	
		µg/kg		µg/l		µg/kg		µg/l		µg/kg	
1,1-Dichloroethane	75343	3.2	U	1	U	2	U	1	U	5.3	U
1,1-Dichloroethene	75354	3.2	U	1	U	2	U	1	U	5.3	U
1,1-Dichloropropene	563586	3.2	U	1	U	2	U	1	U	5.3	U
1,1,1-Trichloroethane	71556	3.2	U	1	U	2	U	1	U	5.3	U
1,1,1,2-Tetrachloroethane	630206	3.2	U	1	U	2	U	1	U	5.3	U
1,1,2-Trichloroethane	79005	3.2	U	1	U	2	U	1	U	5.3	U
1,2-Dibromo-3-chloropropane	96128	3.2	UJ	1	U	2	UJ	1	U	5.3	UJ
1,2-Dibromoethane	106934	3.2	U	1	U	2	U	1	U	5.3	U
1,2-Dichlorobenzene	95501	3.2	U	1	U	2	U	1	U	5.3	U
1,2-Dichloroethane	107062	3.2	U	1	U	2	U	1	U	5.3	U
1,2-Dichloropropane	78875	3.2	U	1	U	2	U	1	U	5.3	U
1,2,3-Trichlorobenzene	87616	3.2	U	1	U	2	U	1	U	5.3	U
1,2,3-Trichloropropane	96184	3.2	U	1	U	2	U	1	U	5.3	U
1,2,4-Trichlorobenzene	120821	3.2	U	1	U	2	U	1	U	5.3	U
1,2,4-Trimethylbenzene	95636	3.2	U	1	U	2	U	1	U	5.3	U
1,3-Dichlorobenzene	541731	3.2	U	1	U	2	U	1	U	5.3	U
1,3-Dichloropropane	142289	3.2	U	1	U	2	U	1	U	5.3	U
1,3,5-Trimethylbenzene	108678	3.2	U	1	U	2	U	1	U	5.3	U
1,4-Dichlorobenzene	106467	3.2	U	1	U	2	U	1	U	5.3	U
2-Butanone	78933	23.1	U	5	U	19.3	U	5	U	122	U
2-Chlorotoluene	95498	3.2	U	1	U	2	U	1	U	5.3	U
2-Hexanone	591786	15.9	UJ	1	U	10.2	UJ	1	U	26.4	UJ
2,2-Dichloropropane	594207	3.2	U	1	U	2	U	1	U	5.3	U
4-Chlorotoluene	106434	3.2	U	1	U	2	U	1	U	5.3	U
4-Methyl-2-pentanone	108101	3.2	U	1	U	2	U	1	U	5.3	U
Acetone	67641	39.6	U	5	U	27.6	U	5	U	135	U
Bromobenzene	108861	3.2	U	1	U	2	U	1	U	5.3	U
Bromochloromethane	74975	3.2	U	1	U	2	U	1	U	5.3	U
Bromodichloromethane	75274	3.2	U	1	U	2	U	1	U	5.3	U
Bromoform	75252	3.2	U	2	U	2	U	2	U	5.3	U
Bromomethane	74839	6.4	UJ	1	U	4.1	UJ	1	U	10.6	UJ
Carbon Disulfide	75150	3.2	U	1	U	2	U	1	U	6.9	U
Carbon Tetrachloride	56235	3.2	U	1	U	2	U	1	U	5.3	U
Chlorobenzene	108907	3.2	U	1	U	2	U	1	U	5.3	U
Chloroethane	75003	3.2	U	1	U	2	U	1	U	5.3	U
Chloromethane	74873	7	U	1	U	5.2	U	1	U	15.2	U
cis-1,2-Dichloroethene	156592	3.2	U	1	U	2	U	1	U	5.3	U
Cis-1,3-Dichloropropene	10061015	3.4	U	1.1	U	2.1	U	1.1	U	5.6	U

Station Number	CAS Number	1		2		3		4		5	
Dibromochloromethane	124481	3.2	U	1	U	2	U	1	U	5.3	U
Dibromomethane	74953	3.2	U	1	U	2	U	1	U	5.3	U
Dichlorodifluoromethane	75718	3.2	U	1	U	2	U	1	U	5.3	U
Ethane, 1,1,2,2-tetrachl	79345	3.2	UJ	1	U	2	UJ	1	U	5.3	UJ
Ethylbenzene	100414	3.2	U	1	U	2	U	1	U	5.3	U
Hexachlorobutadiene	87683	3.2	U	1	U	2	U	1	U	5.3	U
Isopropylbenzene	98828	3.2	U	1	U	2	U	1	U	5.3	U
Methylene Chloride	75092	15.9	U	1	U	10.2	U	1	U	26.4	U
MP-Xylene		6.4	U	2	U	4.1	U	2	U	10.6	U
n-Propylbenzene	103651	3.2	U	1	U	2	U	1	U	5.3	U
n-Butylbenzene	104518	3.2	U	1	U	2	U	1	U	5.3	U
Naphthalene	91203	3.2	U	1	U	2	U	1	U	5.3	U
o-Xylene	95476	3.2	U	1	U	2	U	1	U	5.3	U
p-Isopropyltoluene	99876	3.2	U	1	U	2	U	1	U	5.3	U
sec-Butylbenzene	135988	3.2	U	1	U	2	U	1	U	5.3	U
Styrene	100425	3.2	U	1	U	2	U	1	U	5.3	U
Tert-butylbenzene	98066	3.2	U	1	U	2	U	1	U	5.3	U
Tetrachloroethene	127184	3.2	U	1	U	2	U	1	U	5.3	U
Toluene	108883	3.2	U	1	U	2	U	1	U	5.3	U
Total Xylenes	1330207	6.4	U	2	U	4.1	U	2	U	10.6	U
trans-1,2-Dichloroethene	156605	3.2	U	1	U	2	U	1	U	5.3	U
Trans-1,3-Dichloropropene	10061026	3	U	0.94	U	1.9	U	0.94	U	5	U
Trichloroethene	79016	3.2	U	1	U	2	U	1	U	5.3	U
Trichlorofluoromethane	75694	3.2	U	1	U	2	U	1	U	5.3	U
Vinyl Chloride	75014	3.2	U	1	U	2	U	1	U	5.3	U

Table C-5. Metals and Pesticides Which Were Not Detected in Cranberry Bog Samples.

Station Number	CAS Number	6	7	8	9
Location		Upper Cranberry Ditch	Upper Cranberry Ditch	Lower Cranberry Ditch	Lower Cranberry Ditch
Media		Sediment	Water	Sediment	Water
EPA Sample Numbers		95240100 95240101	95240103 95240105 95240104 95240102	95240106 95240107	95240111 95240110 95240109 95240108
Metals Measurements					
		mg/kg	µg/l	mg/kg	µg/l
Antimony	7440360	8 U	0.5 U	8 U	0.5 U
Cadmium	7440439	0.08 U	0.3 U	0.08 U	0.3 U
Mercury	7439976	0.02 U	0.1 U	0.03 U	0.1 U
Thallium	7440280	12 U	1 U	12 U	1 U
Tin	7440315	5 U		2.5 U	
Pesticide Measurements					
Units		µg/kg	µg/l	µg/kg	µg/l
2,4-DB	94826	62 UJ	0.16 U	51 UJ	0.12 U
2,4'-DDE	324826	14 U	0.048 U	10 U	0.048 U
2,4,5-T	93765	41 UJ	0.1 U	34 UJ	0.083 U
2,4,5-TB	93801	46 UJ	0.12 U	38 UJ	0.094 U
2,4,5-Trichlorophenol	95954	31 UJ	0.08 U	25 UJ	0.06 U
2,4,6-Trichlorophenol	88062	31 UJ	0.079 U	25 UJ	0.062 U
3,5-Dichlorobenzoic acid	51365	51 UJ	0.13 U	42 UJ	0.1 U
4-Nitrophenol	100027	89 UJ		230 UJ	0.18 UJ
5-Hydroxydicamba	7600502	51 UJ	0 R	42 UJ	0 R
Abate (Temephos)	3383968	200 UJ	0.72 UJ	160 UJ	0.73 UJ
Acifluorfen	50594666			170 UJ	
Acifluorfen (Blazer)	62476599		0.53 U		0.42 U
Alachlor	15972608	82 U	0.29 U	62 U	0.29 U
Aldrin	309002	14 U	0.048 UJ	10 U	0.048 UJ
Alpha-BHC	319846	14 U	0.048 U	10 U	0.048 U
Alpha-Chlordene	56534022		0.048 U		
Ametryn	834128	23 U	0.08 U	17 U	0.081 U
Atraton	1610179	68 U	0.048 U	52 U	0.24 U
Atrazine	1912249	23 U	0.08 U	17 U	0.081 U
Azinphos-ethyl	2642719	36 U	0.13 U	28 UJ	0.13 U
Benefin	1861401	34 U	0.12 U	26 U	0.12 U
Bentazon	25057890	51 UJ	0.2 UJ	63 UJ	0.16 UJ
Benzoic acid, 3-amino-2,	133904	51 UJ	0.13 UJ	42 UJ	0.1 UJ
Beta-BHC	319857	14 U	0.048 U	10 U	0.048 U
Bromacil	314409	91 U	0.32 U	70 U	0.32 U
Bromoxynil	1689845	51 UJ	0.13 U	42 UJ	0.1 U
Butachlor	23184669	80 U	0.63 U	61 U	0.54 U

Station Number	CAS Number	6		7		8		9	
Butylate	2008415	45	U	0.16	U	35	U	0.16	U
Captafol	2425061	16	UJ	0.24	UJ	52	UJ	0.24	UJ
Captan	133062	41	UJ	0.14	UJ	31	UJ	0.14	UJ
Carbophenothion	786196	23	U	0.08	U	17	U	0.081	U
Carboxin	5234685	250	U	0.88	U	190	U	0.89	U
Chlordane (Tech)	57749	91	U	0.32	U	70	U	0.32	U
Chlorpyrifos-ethyl	5598130	16	U	0.056	U	12	U	0.057	U
cis-Chlordane (alpha-Chlordane)	5103719			0.048	U				
cis-Permethrin	52645531	120	UJ	0.16	UJ	35	UJ	0.16	UJ
Coumaphos	56724	27	UJ	0.096	UJ	21	UJ	0.097	UJ
Cyanazine	21725462	34	U	0.12	U	26	U	0.12	U
Cycloate	1134232	45	U	0.16	U	35	U	0.16	U
Daconil	1897456	54	U	0.19	U	42	U	0.19	U
Dalapon	75990	1000	UJ	0	R	850	UJ	0	R
DCPA	1861321	41	UJ	0.1	UJ	34	UJ	0.083	UJ
DDM4	1022226	23	U	0.048	U	10	U	0.048	UJ
DEF	78488	32	U	0.11	U	24	U	0.11	U
Delta-BHC	319868	14	U	0.048	U	10	U	0.048	U
Demeton-0	298033	16	U	0.056	U	12	U	0.057	U
Demeton-s	126750	16	U	0.056	UJ	12	U	0.057	UJ
Diallate-I	2302164	86	U	0.3	U	66	U	0.31	U
Dicamba	1918009	51	UJ	0.13	UJ	34	UJ	0.1	UJ
Dichlorprop	120365	56	UJ	0.14	U	46	UJ	0.11	U
Dichlorvos	62737	18	U	0.064	U	14	U	0.065	U
Diclofop-methyl	51338273	77	UJ	0.2	U	63	UJ	0.16	U
Dieldrin	60571	14	U	0.048	U	10	U	0.048	U
Dimethoate	60515	18	U	0.064	U	14	U	0.065	U
Dinoseb	88857	100	UJ	0.2	U	150	UJ	0.16	U
Dioxathion	78342	39	U	0.14	U	30	U	0.14	U
Diphenamid	957517	68	U	0.24	U	52	U	0.24	U
Disulfoton	298044	14	U	0.28	U	10	U	0.33	U
Diuron	330541	140	UJ	0.48	UJ	100	UJ	0.48	UJ
Endosulfan I	959988	14	U	0.048	U	10	U	0.048	U
Endosulfan II	33213659	14	U	0.048	U	10	U	0.048	U
Endosulfan Sulfate	1031078	14	U	0.048	U	10	U	0.048	U
Endrin	72208	14	U	0.048	U	10	U	0.048	U
Endrin Aldehyde	7421934	14	U	0.048	U	10	U	0.048	U
Endrin Ketone	53494705	14	U	0.048	U	10	U	0.048	U
EPN	2104645	23	U	0.08	U	17	U	0.081	U
Eptam	759944	45	U	0.16	U	35	U	0.16	U
Ethalfuralin (Sonalan)	55283686	34	U	0.07	U	26	U	0.076	U
Ethion	563122	16	U	0.056	U	12	U	0.057	U
Ethoprop	13194484	18	U	0.064	U	14	U	0.065	U
Fenamiphos	22224926	34	U	0.12	U	26	U	0.12	U
Fenarimol	60168889	68	U	0.24	U	52	U	0.24	U
Fenithrothion	122145	16	U	0.056	U	12	U	0.057	U
Fensulfathion	115902	23	UJ	0.08	UJ	17	UJ	0.081	UJ
Fenthion	55389	16	U	0.034	U	12	U	0.038	U
Fenvalerate (total)	51630581	460	UJ	0.32	UJ	35	UJ	0.32	UJ

Station Number	CAS Number	6		7		8		9	
Fluridone	59756604	140	UJ	0.48	UJ	100	UJ	0.48	UJ
Fonophos	944229	14	U	0.048	U	10	U	0.048	U
Gamma-Chlordane	5103742	14	U	0.048	U	10	U	0.048	U
Heptachlor	76448	14	U	0.048	UJ	10	U	0.048	UJ
Heptachlor Epoxide	1024573	14	U	0.048	U	10	U	0.048	U
Hexazinone	51235042	34	UJ	0.12	UJ	26	UJ	0.12	UJ
Imidan	732116	25	UJ	0.088	UJ	19	UJ	0.089	UJ
Ioxynil	1689834	51	UJ	0.13	U	42	UJ	0.1	U
Kelthane	115322	54	U	0.19	U	42	U	0.19	UJ
Lindane	58899	14	U	0.048	U	10	U	0.048	U
Malathion E50	121755	18	U	0.064	U	14	U	0.065	U
MCPA	94746	100	UJ	0.26	U	85	UJ	0.21	U
MCPP	93652	100	UJ	0.26	U	85	UJ	0.21	U
Merphos	150505	36	UJ	0.13	UJ	28	UJ	0.13	UJ
Metalaxyl	57837191	150	U	0.54	U	120	U	0.55	U
Metholachlor	51218452	91	U	0.32	U	70	U	0.32	U
Methoxychlor	72435	14	UJ	0.048	U	10	UJ	0.048	U
Metribuzin	21087649	23	U	0.08	U	17	U	0.081	U
Mevinphos	7786347	23	U	0.08	U	17	U	0.081	U
MGK-264	113484	160	U	0.56	U	120	U	0.57	U
Mirex	2385855	14	U	0.048	U	10	U	0.048	U
Molinate	2212671	45	U	0.16	U	35	U	0.16	U
Oxychlordane	27304138			0.048	U				
Oxyfluorfen	42874033	91	U	0.32	U	70	U	0.32	U
o,o-Diethyl Phosphoric Acid, o-p-Nitroph	311455	41	UJ	6.1	UJ	31	U	7.4	UJ
o,p'-DDT	789026	88	UJ	0.01	U	1.8	UJ	0.0086	U
Parathion	56382	18	U	0.031	U	14	U	0.035	U
Parathion-methyl	298000	16	U	0.056	U	12	U	0.057	U
PCB-1221	11104282	91	U	0.32	U	70	U	0.32	U
PCB-1232	11141165	91	U	0.32	U	70	U	0.32	U
PCB-1242	53469219	91	U	0.32	U	70	U	0.32	U
PCB-1248	12672296	91	U	0.32	U	70	U	0.32	U
PCB-1254	11097691	91	U	0.32	U	70	U	0.32	U
PCB-1260	11096825	91	U	0.32	U	70	U	0.32	U
Pebulate	1114712	45	U	0.16	U	35	U	0.16	U
Pendimethalin	40487421	34	U	0.12	U	26	U	0.12	U
Pentachlorophenol	87865	20	UJ	0.009	U	20	UJ	0.0079	U
Phenol, 2,3,4,5-tetrachl	4901513	28	UJ	0.072	U	23	UJ	0.057	U
Phenol, 2,3,4,6-tetrachl	58902	28	UJ	0.072	U	23	UJ	0.06	U
Phenothrin	26002802	200	UJ	0.16	UJ	0.47	UJ	2	UJ
Phorate	298022	16	U	0.056	U	12	U	0.057	U
Phosphamidan	297994	54	U	0.19	UJ	42	U	0.19	UJ
Picloram	1918021	51	UJ	0	R	42	UJ	0	R
Profluralin	26399360	54	U	0.19	U	42	U	0.19	U
Prometon	1610180	23	U	0.08	U	17	U	0.081	U
Prometryne	7287196	23	UJ	0.08	U	17	UJ	0.081	UJ
Pronamide (kerb)	23950585	91	UJ	0.32	U	70	UJ	0.32	U
Propargite	2312358	45	U	0.16	U	35	U	0.16	U
Propazine	139402	23	U	0.08	U	17	U	0.081	U

Station Number	CAS Number	6		7		8		9	
Propetamphos	31218834	45	U	0.16	U	35	U	0.16	U
Ramrod	1918167	54	U	0.19	U	42	U	0.19	U
Resmethrin	10453868	15	UJ	0.16	UJ	0.17	UJ	2	UJ
Ronnel	299843	16	U	0.056	U	12	U	0.057	U
Silvex	93721	41	UJ	0.1	U	34	UJ	0.083	U
Simazine	122349	23	UJ	0.022	UJ	17	UJ	0.081	UJ
Sulfotep	3689245	14	U	0.048	U	10	U	0.048	U
Sulprofos	35400432	16	U	0.056	U	12	U	0.057	U
Tebuthiuron	34014181	34	U	0.12	U	26	U	0.12	U
Terbacil	5902512	68	U	0.24	U	52	U	0.24	U
Terbutryn (Igran)	886500	23	U	0.08	U	17	U	0.081	U
Tetrachlorvinphos	961115	45	U	0.16	U	35	U	0.16	U
Toxaphene	8001352	450	U	1.6	U	350	U	1.6	U
trans-Nonachlor	39765805			0.048	U				
Triademefon	43121433	59	U	0.21	U	45	U	0.21	U
Triallate	2303175	59	U	0.21	U	45	U	0.21	U
Trifluraline	1582098	34	U	0.12	U	26	U	0.12	U
Vernolate	1929777	45	U	0.16	U	35	U	0.16	U

Table C-6. Metals and Pesticides Which Were Not Detected in Tideflat Samples (Page 1 of 6)

Station Number	CAS Number	10	11	12	12A	13	14	23
Location		Willapa Bay, Oyster Bed	Willapa Bay, Oyster Bed	SBIR, Swimming Hole, 1994	SBIR, Swimming Hole, 1995	Hawks Point Shellfish Area	Willapa Bay Ellen Sands	Grays Harbor, South Bay
EPA Sample Number		94344301	94344302	94344303	95080022	9434304	9434300	95080020
Media		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Metals Measurements:								
		mg/kg		mg/kg		mg/kg		mg/kg
Cadmium	7440439	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Selenium	7782492	0.2 U	0.2 U	0.2 U	0.8 U	0.2 U	0.2 U	0.8 U
Thallium	7440280	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tin	7440315	2.5 U	2.5 U	2.5 U		2.5 U	2.5 U	
Pesticides Measurements:								
		ug/kg		ug/kg		ug/kg		ug/kg
1-Naphthol	90153	5.532 U	4.905 U	6.626 U	4.064 U	4.749 U	4.882 U	6.868 U
1,3-Dinitrobenzene	99650				433.3 U			469.7 U
1,2-Dibromo-3-chloropropane	96128	2.9 U	2.3 U	3.1 U		2.3 U	2.3 U	
1,2-Dibromoethane	106934	2.9 U	2.3 U	3.1 U		2.3 U	2.3 U	
2-Nitrotoluene	88722				260 U			281.8 U
2,4,6-Trichlorophenol	88062	39 U	36 U	45 U	43 U	36 U	33 U	82 U
2,6-Dinitrotoluene	606202				260 U			281.8 U
2,4-Dinitrotoluene	121142				260 U			281.8 U
2,4,5-Trichlorophenol	95954	39 U	35 U	44 U	42 U	35 U	32 U	81 U
2,4-DB	94826	81 U	74 U	92 U	88 U	73 U	67 U	168 U
2,4-D	94757	67 U	61 U	76 U	73 U	61 U	56 U	139 U
2,4,5-TB	93801	61 U	55 U	69 U	66 U	55 U	51 U	126 U
2,4,5-T	93765	53 U	49 U	61 U	58 U	48 U	44 U	111 U
3-OH-Carbofuran	16655826	2.766 U	2.453 U	3.313 U	2.032 U	2.375 U	2.441 U	3.434 U
3,5-Dichlorobenzoic acid	51365	65 U	60 U	74 U	71 U	59 U	55 U	136 U
4-Nitrophenol	100027	115 U	104 U	130 U	121 U	104 U	96 U	230 U

Station Number	CAS Number	10		11		12		12A		13		14		23	
4-Nitrotoluene	99990							260	U					281.8	U
5-Hydroxydicamba	7600502	67	U	61	U	76	U	73	U	60	U	55	U	138	U
Abate (Temephos)	3383968	293	UJ	220	UJ	358	UJ	397	UJ	250	UJ	249	UJ	663	UJ
Alachlor	15972608	78	U	58.8	U	95.5	U	159	U	66.6	U	66.5	U	265	U
Aldicarb sulfoxide	1646873	2.766	U	2.453	U	3.313	U			2.375	U	2.441	U		
Aldicarb	116063	2.766	U	2.453	U	3.313	U			2.375	U	2.441	U		
Aldrin	309002	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Alpha-BHC	319846	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Ametryn	834128	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Atraton	1610179	97.5	U	73.5	U	119	U	132	U	83	U	83.1	U	221	U
Atrazine	19312249							44	U					74	U
Atrazine	1912249	32.5	U	24.5	U	39.8	U			27.8	U	27.7	U		
Azinphos-methyl	86500	52	U	39.2	U	63.6	U	71	UJ	44.4	U	44.3	U	118	UJ
Azinphos-ethyl	2642719	52	U	39.2	U	63.6	U	71	UJ	44.4	U	44.3	U	118	UJ
Benefin	1861401	48.8	U	36.7	U	59.7	U	66	U	41.6	U	41.6	U	111	U
Bentazon	25057890	100	U	91	U	114	U	109	U	91	U	83	U	208	U
Benzene, 1-methyl-3-nitr	99081							260	U					281.8	U
Benzene, Trinitro-	99354							433.3	U					469.7	U
Benzene, 2-methyl-1,3,5-trinitro-	118967							433.3	U					469.7	U
Benzonitrile, 2,6-dichlo	1194656	39	U	29.4	U	47.7	U	88	U	33.3	U	33.3	U	147	U
Beta-BHC	319857	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Bromacil	314409	195	U	147	U	239	U	177	U	167	U	166	U	295	U
Butachlor	23184669	113.8	U	85.7	U	139	U	155	U	97	U	97	U	258	U
Butylate	2008415	48.8	U	36.7	U	59.7	U	88	U	41.6	U	41.6	U	147	U
Carbaryl	63252	2.766	U	4.453	U	3.313	U	2.032	U	2.375	U	2.441	U	3.434	U
Carbofuran	1563662	2.766	U	2.453	U	3.313	U	2.032	U	2.375	U	2.441	U	3.434	U
Carbophenothion	786196	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Carboxin	5234685	358	U	269	U	438	U	486	U	305	U	305	U	811	U
Chlordane (Tech)	57749	130	U	98	U	159	U	171	U	111	U	111	U	313	U
Chlorpropham (CIPC)	101213	163	U	122	U	199	U	177	U	139	U	139	U	295	U
Chlorpyrifos-ethyl	5598130	22.8	U	17.1	U	27.8	U	35	U	19.4	U	19.4	U	59	U
Coumaphos	56724	39	U	29.4	U	47.7	U	53	UJ	33.3	U	33.3	U	88	UJ

Station Number	CAS Number	10		11		12		12A		13		14		23	
Cyanazine	21725462	48.8	U	36.7	U	59.7	U	66	UJ	41.6	U	41.6	U	111	UJ
Cycloate	1134232	48.8	U	36.7	U	59.7	U	88	U	41.6	U	41.6	U	147	U
Daconil	1897456	78	UJ	58.8	UJ	95.5	UJ	106	U	66.6	UJ	66.5	UJ	177	U
DCPA (dacthal)	18611321							56	U					108	U
DCPA	1861321	52	U	47	U	59	U			47	U	43	U		
DEF	78488	45.5	U	34.3	U	55.7	U	62	U	38.9	U	38.8	U	103	U
Delta-BHC	319868	9.75	U	7.35	U			13	U	8.3	U	8.31	U	23	U
Demeton-s	126750	22.8	U	17.1	U	27.8	U	62	UJ	19.4	U	19.4	U	103	UJ
Demeton-0	298033	22.8	U	17.1	U	27.8	U	62	UJ	19.4	U	19.4	U	103	UJ
Diallate	2303164	124	U	93	U	151	U	168	U	106	U	105	U	280	U
Diazinon	333415	26	U	19.6	U	31.8	U	35	UJ	22.2	U	22.2	U	59	UJ
Dicamba	1918009	66	U	60	U	75	U	72	U	60	U	55	U	138	U
Dichlorprop	120365	73	U	67	U	83	U	80	U	67	U	61	U	152	U
Dichlorvos	62737	26	U	19.6	U	31.8	U	35	U	22.2	U	22.2	U	59	U
Diclofop-methyl	51338273	106	U	96	U	120	U	115	UJ	96	U	88	U	220	UJ
Dieldrin	60571	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	47	U
Dimethoate	60515	26	U	19.6	U	31.8	U	35	UJ	22.2	U	22.2	U	59	UJ
Dioxathion	78342	55.3	U	41.6	U	67.6	U	75	UJ	47.2	U	47.1	U	125	UJ
Diphenamid	957517	97.5	U	73.5	U	119	U	132	U	83	U	83.1	U	221	U
Disulfoton	298044	19.5	U	14.7	U	23.9	U	26	UJ	16.7	U	16.6	U	44	UJ
Diuron	330541	195	U	147	U	239	U	265	UJ	167	U	166	U	442	UJ
Endosulfan Sulfate	1031078	19.5	U			23.9	U	26	U	16.7	U	16.6	U	47	U
Endosulfan II	33213659	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	47	U
Endosulfan I	959988	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Endrin	72208	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	47	U
Endrin Ketone	53494705	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	47	UJ
Endrin Aldehyde	7421934	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	47	UJ
EPN	2104645	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Eptam	759944	48.8	U	36.7	U	59.7	U	88	U	41.6	U	41.6	U	147	U
Ethalfuralin (Sonalan)	55283686	48.8	U	36.7	U	59.7	U	66	U	41.6	U	41.6	U	111	U
Ethion	563122	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Ethoprop	13194484	26	U	19.6	U	31.8	U	35	U	22.2	U	22.2	U	59	U

Station Number	CAS Number	10		11		12		12A		13		14		23	
Fenamiphos	22224926	48.8	U	36.7	U	59.7	U	66	U	41.6	U	41.6	U	111	U
Fenarimol	60168889	97.5	U	73.5	U	119	U	132	U	83	U	83.1	U	221	U
Fenithrothion	122145	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Fensulfthion	115902	32.5	U	24.5	U	39.8	U	71	U	27.8	U	27.7	U	118	U
Fenthion	55389	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Fluridone	59756604	260	U	196	U	318	U	265	UJ	222	U	222	U	442	UJ
Fonophos	944229	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	44	U
Heptachlor Epoxide	1024573	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Heptachlor	76448	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Hexazinone	51235042	48.8	U	36.7	U	59.7	U	66	UJ	41.6	U	41.6	U	111	UJ
Imidan	732116	35.8	U	26.9	U	43.8	U	49	UJ	30.5	U	30.5	U	81	UJ
Lindane	58899	9.75	U	7.35	U	11.9	U	13	U	8.3	U	8.31	U	23	U
Malathion E50	121755	26	U	19.6	U	31.8	U	35	U	22.2	U	22.2	U	59	U
MCPA	94746	132	U	120	U	150	U	144	U	120	U	110	U	274	U
MCPP	93652	135	U	123	U	154	U	147	U	123	U	113	U	281	U
Mercaptodimethur	2032657	5.532	U	4.905	U	6.626	U	4.064	U	4.749	U	488.2	U	6.868	U
Mercury Methyl	115093	150	U	130	U	170	U	5.76	UJ	110	U	110	U	6.56	UJ
Merphos	150505	52	U	39.2	U	63.6	U	53	UJ	44.4	U	44.3	U	88	UJ
Metalaxyl	57837191	221	U	167	U	271	U	300	U	189	U	188	U	501	U
Metholachlor	51218452	97.5	U	73.5	U	119	U	177	U	83	U	83.1	U	295	U
Methomyl	16752775	2.766	U	2.453	U	3.313	U			2.375	U	2.441	U		
Methoxychlor	72435	19.5	U	14.7	U	23.9	U	26	UJ	16.7	U	16.6	U	47	U
Methyl Paraoxon								79	U					133	U
Methyl Chlorpyrifos								35	U					59	U
Metribuzin	21087649	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Mevinphos	7786347	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
MGK-264	113484	228	U	171	U	278	U	309	U	194	U	194	U	516	U
Molinate	2212671	84.5	U	63.7	U	103	U	88	U	72	U	72.1	U	147	U
Monocrotophos	6923224							309	UJ					516	UJ
Napropamide	15299997	97.5	U	73.5	U	119	U	132	U	83	U	83.1	U	221	U
Nitrobenzene	98953							433.3	U					469.7	U
Norflurazon	27314132	48.8	U	36.7	U	59.7	U	88	UJ	41.6	U	41.6	U	147	UJ

Station Number	CAS Number	10		11		12		12A		13		14		23	
o,o-Diethyl Phosphoric Acid, o-p-Nitroph	311455	58.5	U	44.1	U	71.6	U			50	U	49.9	U		
Oxyfluorfen	42874033	84.5	U	63.7	U	103	U	88	U	72	U	72.1	U	147	U
p,p'-DDT	50293	19.5	U	14.7	U	23.9	U	26	UJ	16.7	U	16.6	U	47	UJ
p,p'-DDD	72548	19.5	U	14.7	U	23.9	U	26	UJ	16.7	U	16.6	U	47	UJ
p,p'-DDE	72559	19.5	U	14.7	U	23.9	U	26	UJ	16.7	U	16.6	U	47	UJ
Parathion	56382	26	U	19.6	U	31.8	U	35	U	22.2	U	22.2	U	59	U
Parathion-methyl	298000	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
PCB-1254	11097691	130	U	98	U	159	U	171	U	111	U	111	U	313	U
PCB-1248	12672296	130	U	98	U	159	U	171	U	111	U	111	U	313	U
PCB-1016	12674112	130	U	98	U	159	U	171	U	111	U	111	U	313	U
PCB-1260	11096825	130	U	98	U	159	U	171	U	111	U	111	U	313	U
PCB-1232	11141165	260	U	196	U	318	U	341	U	222	U	222	U	626	U
PCB-1242	53469219	130	U	98	U	159	U	171	U	111	U	111	U	313	U
PCB-1221	11104282	130	U	98	U	159	U	171	U	111	U	111	U	313	U
Pebulate	1114712	78	U	58.8	U	95.5	U	88	U	66.6	U	66.5	U	147	U
Pendimethalin	40487421	48.8	U	36.7	U	59.7	U	66	U	41.6	U	41.6	U	111	U
Pentachlorophenol	87865	33	U	31	U	38	U	37	U	30	U	28	U	70	U
Phenol, 2,3,4,6-tetrachl	58902	37	U	33	U	42	U	40	U	33	U	30	U	76	U
Phenol, 2,3,4,5-tetrachl	4901513	37	U	33	U	42	U	40	U	33	U	30	U	76	U
Phorate	298022	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Phosphamidan	297994	78	U	58.8	U	95.5	U	106	UJ	66.6	U	66.5	U	177	UJ
Picloram	1918021	67	U	61	U	77	U	73	UJ	61	U	56	U	140	UJ
Profluralin	26399360	78	U	58.8	U	95.5	U	106	U	66.6	U	66.5	U	177	U
Prometon	1610180	32.5	U	24.5	U	39.8	U	44	UJ	27.8	U	27.7	U	74	UJ
Prometryne	7287196	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Pronamide (kerb)	23950585	97.5	U	73.5	U	119	U	177	U	83	U	83.1	U	295	U
Propazine	139402	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Propetamphos	31218834	65	U	49	U	79.6	U	88	U	55.5	U	55.4	U	147	U
Propoxur	114261	2.766	U	2.453	U	3.313	U	2.032	U	2.375	U	2.441	U	3.434	U
Ramrod	1918167	65	U	49	U	79.6	U	106	U	55.5	U	55.4	U	177	U
Ronnel	299843	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Silvex	93721	53	U	48	U	60	U	58	U	48	U	44	U	110	U

Station Number	CAS Number	10		11		12		12A		13		14		23	
Simazine	122349	32.5	U	24.5	U	39.8	U	44	UJ	27.8	U	27.7	U	74	UJ
Sulfotep	3689245	19.5	U	14.7	U	23.9	U	26	U	16.7	U	16.6	U	44	U
Sulprofos	35400432	22.8	U	17.1	U	27.8	U	31	U	19.4	U	19.4	U	52	U
Tebuthiuron	34014181	32.5	U	24.5	U	39.8	U	66	U	27.8	U	27.7	U	111	U
Terbacil	5902512	163	U	122	U	199	U	132	U	139	U	139	U	221	U
Terbutryn (Igran)	886500	32.5	U	24.5	U	39.8	U	44	U	27.8	U	27.7	U	74	U
Tetrabutyltin	1461252	4.5	U	3.7	U	5.6	U	11.3	U	4.4	U	4.8	UJ	7.9	U
Tetrachlorvinphos	961115	65	U	49	U	79.6	U	88	U	55.5	U	55.4	U	147	U
Tetryl	479458							433.3	U					469.7	U
Toxaphene	8001352	390	U	294	U	477	U	512	U	333	U	333	U	939	U
Triademefon	43121433	84.5	U	63.7	U	103	U	115	U	72	U	72.1	U	192	U
Triallate	2303175	84.5	UJ	63.7	UJ	103	UJ			72	UJ	72.1	UJ		
Trichlopyr	55335063	53	U	49	U	61	U	58	U	49	U	45	U	111	U
Trifluraline	1582098	48.8	U	36.7	U	59.7	U	66	U	41.6	U	41.6	U	111	U
Vernolate	1929777	48.8	U	36.7	U	59.7	U	88	U	41.6	U	41.6	U	147	U
Vydate	23135220	2.766	U	2.453	U	3.313	U			2.375	U	2.441	U		

Appendix D: METHOD BLANKS WHICH HAD TARGET COMPOUNDS ABOVE THE QUANTITATION LIMITS

Table D-1. Metals Measurements of Method Blank Samples

Table D-2. Pesticide Measurements of Method Blank Samples

Table D-3. Semi-Volatile Organics Measurements of Method Blank Samples

Table D-1. Metals Measurements in Method Blank Samples¹

TIDEFLATS SAMPLES											
Target Compound	Units	CAS #	Blank #		Blank #		Blank #		Blank #		Blank #
					ES940830						
Aluminum	mg/kg	7429905			3.3	P					
Calcium	mg/kg	7440702			2.97						
Chromium	mg/kg	7440473			0.98	P					
Copper	mg/kg	7440508			0.38	P					
Iron	mg/kg	7439896			6.59						
Lead	mg/kg	7439921			0.16	P					
Magnesium	mg/kg	7439954			2	P					
Manganese	mg/kg	7439965			0.49	P					
Sodium	mg/kg	7440235			13.1						
DUMP SAMPLES											
			S950316A						W950308A		W950308
Aluminum	mg/kg	7429905	2	U							4.2 P
Antimony	mg/kg	7440360	5	PN							0.56 P
Barium	mg/kg	7440393	0.2	U							2.7 P
Calcium	ug/l	7440702	1.38						5	U	
Iron	ug/l	7439896	3.37						10	U	
Lead	mg/kg	7439921	0.1	U							1.56
Sodium	ug/l	7440235	2	U					76	P	
CRANBERRY BOG SAMPLES											
					EW950801		ES950721				
Aluminum	ug/l	7429905			20	U	0.87	P			
Barium	ug/l	7440393			2	U	0.38				
Calcium	ug/l	7440702			36.1		1.5				
Iron	ug/l	7439896			10	U	0.68	P			
Sodium	ug/l	7440235			27	P	12.7				
Zinc	ug/l	7440666			4.8	P	1.77				

¹These Method Blank Samples Had Target Compounds Above Method Quantitation Limits.

Table D-2. Pesticide Measurements in Method Blank Samples¹

TIDEFLATS SAMPLES											
Target Compound	Units	CAS #	Blank #		Blank #		Blank #		Blank #		Blank #
			BS4243H								
Dichlorobenzoic Acid	µg/kg		46	R							
Dinoseb	µg/kg	88857	71	R							
DUMP SAMPLES											
			BW5059D		BS5061		BS5061D		SQ5066		SQ5066D
4-Nitrophenol	µg/l	100027	0.393	R							
Acifluorfen	µg/l	50594666	0.967	R	258	R	258	R			
Benzoic acid, 3-amino-2,	µg/l	133904	0.234	R	62	R	62	R			
Butyltin trichloride	µg/kg	1118463									11.4 J
Dibutyltin dichloride	µg/kg	683181							12.6	J	16.6 J
Dinoseb	µg/l	88857	0.354	R	95	R	95	R			
Tetrabutyltin	µg/kg	1461252							8.5	J	
Tributyltin chloride	µg/kg	1461229							125	J	126 J

¹These Method Blank Samples Had Target Compounds Above Method Quantitation Limits.

Table D-3. Semi-volatile Organics Measurements in Method Blank Samples¹

DUMP SAMPLES									
Target Compound	Units	CAS #	Blank #		Blank #		Blank #		
			BS4243		BS4243D		VBS4242		
1,3,5-Trimethylbenzene	µg/kg	108678					0.03	J	
1,4-Dichlorobenzene	µg/kg	106467	30.3	U	30.3	U	0.06	J	
1,2,4-Trimethylbenzene	µg/kg	95636					0.06	J	
1,2,3-Trichlorobenzene	µg/kg	87616					0.21	J	
1,2,4-Trichlorobenzene	µg/kg	120821	30.3	U	30.3	U	0.14	J	
1,3-Dichlorobenzene	µg/kg	541731	30.3	U	30.3	U	0.04	J	
1,2-Dichlorobenzene	µg/kg	95501	30.3	U	30.3	U	0.07	J	
17-Octadecenal	µg/kg	56554860	31.9	NJ					
2-Butanone	µg/kg	78933					1	J	
2-Pentanone, 4-hydroxy-4	µg/kg	123422	74600	NJ	122000	NJ			
2-Pyrrolidinone, 1-methy	µg/kg	872504			399	NJ			
3-Penten-2-one, 4-methyl	µg/kg	141797	8	NJ	14	NJ			
4-Penten-2-one, 4-methyl	µg/kg	3744023	2790	NJ	3540	NJ			
9H-Fluorene	µg/kg	86737	1.2	J	30.3	U			
Acetic acid, 1-methyleth	µg/kg	108214			455	NJ			
Acetone	µg/kg	67641					4.8	J	
Benzene	µg/kg	71432					0.18	J	
Benzoic acid	µg/kg	65850	60.4	J	143	J			
Benzyl alcohol	µg/kg	100516	12.5	J	30.3	U			
Bis(2-ethylhexyl) phthal	µg/kg	117817	142		73.2				
Butylbenzylphthalate	µg/kg	85687	4	J	30.3	U			
Carbon Disulfide	µg/kg	75150					0.98	J	
Chlorobenzene	µg/kg	108907					0.08	J	
Chloroform	µg/kg	67663					0.09	J	
Chloromethane	µg/kg	74873					0.09	J	
Di-n-Butylphthalate	µg/kg	84742	41.9		30.3	U			
Diethyl phthalate	µg/kg	84662	6.2	J	6.7	J			
Glycocyanidine	µg/kg	503866	106	NJ					
Hexachlorobutadiene	µg/kg	87683	30.3	U	30.3	U	0.08	J	
Hydrocarbon Unknown 02	µg/kg		106	J					
Hydrocarbon Unknown 01	µg/kg		39.6	NJ	849	J			
Isopropylbenzene	µg/kg	98828					0.04	J	
Methylene Chloride	µg/kg	75092					0.37	J	
mp-Xylene	µg/kg						0.05	J	
n-Butylbenzene	µg/kg	104518					0.08	J	
Naphthalene	µg/kg	91203	30.3	U	30.3	U	0.44	J	
o-Xylene	µg/kg	95476					0.02	J	
Octadecanoic acid	µg/kg	57114	49.4	NJ	59.1	NJ			
Pentachlorophenol	µg/kg	87865	3.5	J	6.5	J			
Phenanthrene	µg/kg	85018	3.2	J	30.3	U			

DUMP SAMPLES								
Phenol	µg/kg	108952	13.1	J	17.7	J		
Phthalate unknown 15	µg/kg				2170	J		
Phthalate unknown 16	µg/kg				682	J		
Toluene	µg/kg	108883					0.06	J
Total Xylenes	µg/kg	1330207					0.07	J
Trichloroethene	µg/kg	79016					0.05	J
Unknown 09	µg/kg		30	J	2050	J		
Unknown 10	µg/kg		382	J	176	J		
Unknown 14	µg/kg				563	J		
Unknown 08	µg/kg		19.2	J				
Unknown 07	µg/kg		140	J	187	J		
Unknown 06	µg/kg		643	J	124	J		
Unknown 12	µg/kg		474	J	40.7	J		
Unknown 05	µg/kg		574	J	1410	J		
Unknown 04	µg/kg		242	J	208	J		
Unknown 11	µg/kg		2130	J	184	J		
Unknown 03	µg/kg		78.6	J	44.3	J		
Unknown 13	µg/kg		799	J	116	J		
Unknown 01	µg/kg		174	J	203	J		
Unknown 02	µg/kg		35	J	232	J		

¹These Method Blank Samples Had Target Compounds Above Method Quantitation Limits.

**APPENDIX E: QUALITY CONTROL DATA FOR FIELD AND LABORATORY
DUPLICATE SAMPLES AND FOR MATRIX SPIKE/MATRIX SPIKE DUPLICATE
(MS/MSD) SAMPLES**

Table E-1. QC Data for Metals Measurements of Drinking Water Samples

Table E-2. QC Data for General Chemistry Measurements of Drinking Water Samples

Table E-3. MS/MSD Organics Measurements of Tideflat Samples #10, 11, and 12A

Table E-4. MS/MSD Organics Measurements of Samples #13 and 14

Table E-5. MS/MSD Organics Measurements of Samples #2 and 23

Table E-6. MS/MSD Organics Measurements of Samples #4 and 5

Table E-7. MS/MSD Organics Measurements of Samples #5 and 8

Table E-8. MS/MSD Organics Measurements of Samples #7

Table E-9. MS/MSD Metals Measurements of Samples #2 and 14

Table E-10. MS/MSD Metals Measurements of Samples #4 and 23

Table E-11. MS/MSD Metals Measurements of Samples #6 and 7

Table E-12. MS/MSD Metals Measurements of Samples #8 and 9

Table E-13. MS/MSD General Chemistry Measurements of Samples #2 and 4

Table E-14. MS/MSD Organics Measurements of Samples #10 and 11

Table E-15. MS/MSD Organics Measurements of Samples #12A and 13

Table E-16. MS/MSD Organics Measurements of Samples #14 and 2

Table E-17. MS/MSD Organics Measurements of Samples #23

Table E-18. MS/MSD Organics Measurements of Samples #4 and 5

Table E-19. MS/MSD Organics Measurements of Samples #7

Table E-20. MS/MSD Organics Measurements of Samples #8

Table E-21. Blind Duplicate Inorganic Measurements of Drinking Water Samples

Table E-22. Laboratory Duplicate Inorganics Measurements of Dump Site Samples

Table E-23. Laboratory Duplicate Inorganics Measurements of Cranberry Bog Samples

Table E-24. Laboratory Duplicate Metals Measurements of Cranberry Bog Samples

Table E-1. QC Data for Metals Measurements in Drinking Water Samples

Station Number	35		35 field dup		39		39		39		39		44		45		45		45		46		46		46		46	
Sample Location	outdoor tap		outdoor tap		kitchen tap		lab dup.		matrix spike	mat sp dup	kitchen tap		bathroom tap		matrix spike	mat sp dup	kitchen tap		lab dup.		matrix spike	mat sp dup						
EPA Number	95430516		95430517		95430505		95430505		95430505	95430505	95430514		95430515		95430515	95430515	95430518		95430518		95430518	95430518						
	µg/l		µg/l		µg/l		µg/l		% rec	% rec	µg/l		µg/l		% rec	% rec	µg/l		µg/l		% rec	% rec						
Aluminum	20	U	20	U	20	U	20	U	107	105	30	P	20	U	103	103	20	U										
Antimony	0.5	U	0.5	U	0.5	U	0.5	U	104	107	0.5	U	0.5	U			0.5	U	0.5	U	116	116						
Arsenic	5.3		5.28		4.2	P	4.2	P	107	107	1	U	1.1	P			1.7	P	1.7	P	106	107						
Barium	2	U	2	U	2	U	2	U	101	100	2	U	11.6		98	99	2	U										
Beryllium	0.5	U	0.5	U	0.5	U	0.5	U	104	103	0.5	U	0.5	U	101	102	0.5	U										
Boron	16	P	17	P	21	P	20	P	100	99	17	P	46	P	96	96	18	P										
Cadmium	2	U	2	U	2	U	2	U	104	103	2	U	2	U	100	100	2	U										
Calcium	16100		16100		23900		23800		109	NA	7720		38100		NA	NA	12400											
Chromium	5	U	5	U	5	U	5	U	104	103	5	U	5	U	101	101	5	U										
Cobalt	10	U	10	U	10	U	10	U	103	102	10	U	10	U	101	101	10	U										
Copper	1.3	P	1.3	P	1	U	1	U	99	98	46		1	U			40.5		43.6		99	98						
Iron	10	U	10	U	186		187		103	102	25.8		1160		98	100	16	P										
Lead	0.5	U	0.5	U	0.5	U	0.5	U	101	101	0.55	P	0.5	U			0.88	P	0.89	P	101	100						
Magnesium	5590		5560		4740		4740		122	NA	2410		14700		NA	NA	5360											
Manganese	1.1	P	1	U	138		138		102	101	1	U	165		99	99	1	U										
Mercury	0.2	U	0.2	U	0.2	U					0.2	U	0.2	U			0.2	U										
Molybdenum	5	U	5	U	5	U	5	U	103	102	5	U	5	U	101	101	5	U										
Nickel	10	U	10	U	10	U	10	U	102	101	10	U	10	U	100	100	10	U										
Potassium	1900	P	2000		3130		2880		101	103	820	P	8440		104	102	1500	P										
Selenium	2	U	2	U	2	U	2	U	121	124	2	U	2	U			2	U	2	U	117	118						
Silica	25200		25100		36100		36100		NA	NA	19500		49100		93	93	32400											
Silver	3	U	3	U	3	U	3	U	93	92	3	U	3	U	94	93	3	U										
Sodium	9800		9740		11600		11600		NA	NA	7360		9810		NA	NA	14500											
Thallium	1	U	1	U	1	U	1	U	100	101	1	U	1	U			1	U	1	U	100	101						
Vanadium	8.3	P	8	P	3	U	3	U	104	102	3	U	3	U	100	100	15											
Zinc	7.7	P	9.6	P	4.2	P	4.3	P	104	103	4	U	4.1	P	101	100	140											

Table E-2. QC Data for General Chemistry Measurements in Drinking Water Samples

Station Number	8		8		8	8	35		35 field dup	
Sample Location	kitchen tap		lab dup.		matrix spike	matrix spike dup.	outdoor tap		outdoor tap	
EPA Number	95430508		95430508		95430508	95430508	95430516		95430517	
					% rec	% rec				
Mercury	0.2 ug/l	U	0.2 ug/l	U	109	110	0.2 ug/l	U	0.2 ug/l	U
Lead, Purged Tap	0.2 ug/l	U	0.2 ug/l	U	109	110	0.2 ug/l	U	0.2 ug/l	U
Lead, First Pour	0.76 ug/l	P	0.77 ug/l	P	95	94				
Chloride	16.5 mg/l		16.5 mg/l		95.8	93.8	11.6 mg/l		11.6 mg/l	
Site Number	9		9		9	9	35		35 field dup	
Sample Location	kitchen tap		lab dup.		matrix spike	matrix spike dup.	outdoor tap		outdoor tap	
EPA Number	95430501		95430501		95430501	95430501	95430516		95430517	
Chloride	16.5 mg/l		16 mg/l		95.8	93.8				
Site Number	34		34		34	34	35		35 field dup	
Sample Location	laundry tap		lab dup.		matrix spike	matrix spike dup.	outdoor tap		outdoor tap	
EPA Number	95430535		95430535		95430535	95430535	95430516		95430517	
Lead-First Pour	0.50 ug/l	U	0.51 ug/l	P	95	95				
Site Number	36		36		36	36	35		35 field dup	
Sample Location	kitchen tap		lab dup.		matrix spike	matrix spike dup.	outdoor tap		outdoor tap	
EPA Number	95430500		95430500		95430500	95430500	95430516		95430517	
					% rec	% rec				
Alkalinity	60.6 mg/l		61.1 mg/l		97.3	99.7	73.1 mg/l		60 mg/l	
Ammonia,N	0.23 mg/l	H J N	0.16 mg/l	H J N	46.2	43.7				
Nitrate-N + Nitrite-N+	0.037 mg/l		0.034 mg/l		98.2	92.2	0.036 mg/l		0.04 mg/l	

Site Number	41		41		41	41	35		35 field dup	
Sample Location	kitchen tap		lab dup.		matrix spike	matrix spike dup.	outdoor tap		outdoor tap	
EPA Number	95430510		95430510		95430510	95430510	95430516		95430517	
					% rec	% rec				
Fluoride	0.251 mg/l		0.249 mg/l		90.5	86.8	0.192 mg/l		0.193 mg/l	
Chloride	7.77 mg/l		7.72 mg/l		101	101				
Sulfate	2.99 mg/l		2.71 mg/l		90.6	92.3	5.06 mg/l		5.07 mg/l	

Table E-3. Matrix spiked/matrix spiked duplicate (MS/MSD) Organics Measurements of Samples 10, 11, and 12A

Station Number			10		10		10		11		11		11		12A		12A		12A	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			94334301-0		94334301-S1		94334301-S2		94334302-0		94334302-S1		94334302-S2		95080022-0		95080022-S1		95080022-S2	
1,3-Dichloropropane	µg/kg	142289	3.5	U	86.66		81.95													
1,2-Diphenylhydrazine	µg/kg	122667							108	U										
1,1-Dichloroethane	µg/kg	75343	3.5	U	97.33		92.5													
1,2-Dichloropropane	µg/kg	78875	3.5	U	95.91		87.95													
1,1-dichloroethene	µg/kg	75354	3.5	U	100.44		75.59													
1,2-Dibromo-3-chloropropane	µg/kg	96128	3.5	U	76.67		84.84													
1,2,3-Trichloropropane	µg/kg	96184	3.5	U	89.58		87.39													
1,1,2-Trichloroethane	µg/kg	79005	3.5	U	97.11		88.93													
1,2,4-Trimethylbenzene	µg/kg	95636	3.5	U	83.72		77.92													
1,2-Dichlorobenzene	µg/kg	95501	3.5	U	79.59		77.03		108	U	68.14		31.89							
1,2,3-Trichlorobenzene	µg/kg	87616	3.5	UJ	47.07		53.52													
1,3,5-Trimethylbenzene	µg/kg	108678	3.5	U	84.58		80.01													
1,1-Dichloropropene	µg/kg	563586	3.5	U	88.65		83.45													
1,2-Dichloroethane	µg/kg	107062	3.5	U	91.82		83.5													
1,2-Dibromoethane	µg/kg	106934	3.5	U	70.17		71.31													
1,4-Dichlorobenzene	µg/kg	106467	3.5	U	72.56		69.84		108	U	65.36		29.38							
1,2,4-Trichlorobenzene	µg/kg	120821	3.5	UJ	46.08		49.07		108	UJ	71.51		36.81							
1,1,1,2-Tetrachloroethane	µg/kg	630206	3.5	U	65.93		68.94													
1,1,1-Trichloroethane	µg/kg	71556	3.5	U	92.8		85.24													
1,3-Dichlorobenzene	µg/kg	541731	3.5	U	74.01		70.92		108	U	62.79		27.5							
1H-Indole, dibromo	µg/kg		35	J																
2,6-Dinitrotoluene	µg/kg	606202							108	U	85.44		72.25							
2-Hexanone	µg/kg	591786	3.4	J	36		34													
2,4,6-Trichlorophenol	µg/kg	88062							108	U	86.22		72.18							
2-Nitrophenol	µg/kg	88755							108	UJ	82.59		44.85							
2,2-Dichloropropane	µg/kg	594207	3.5	U	92.12		82.29													
2,4-Dichlorophenol	µg/kg	120832							108	U	80.3		60.1							
2,4-Dimethylphenol	µg/kg	105679							108	U	78.46		66.33							
2,4-Dinitrotoluene	µg/kg	121142							108	U	87.7		71.14							
2-Butanone	µg/kg	78933	15.1	U		NAR		NAR												

Station Number			10		10		10		11		11		11		12A		12A		12A	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
2-Chlorotoluene	µg/kg	95498	3.5	U	86.05		80.56													
2,4,5-Trichlorophenol	µg/kg	95954							108	U	93.95		82.51							
2-Chlorophenol	µg/kg	95578							108	U	81.17		50.85							
2-Methylphenol	µg/kg	95487							108	U	89.04		64.21							
2-Chloronaphthalene	µg/kg	91587							108	U	83.55		60.69							
2,4-Dinitrophenol	µg/kg	51285							1080	UJ	69.56	J	53.18	J						
2-Nitroaniline	µg/kg	88744							108	U	107.52		88.43							
3-Nitroaniline	µg/kg	99092							108	UJ	36.47		21.88							
4-Chloro-3-methylphenol	µg/kg	59507							108	U	96.58		77.26							
4-Nitrophenol	µg/kg	100027							541	UJ	99.74	J	81.19	J						
4-Nitroaniline	µg/kg	100016							108	UJ	59.74		41.26							
4,6-Dinitro-2-methylphenol	µg/kg	534521							1080	U	89.87		68.34							
4-Chlorotoluene	µg/kg	106434	3.5	U	76.75		73.61													
4-Chlorophenyl-Phenylether	µg/kg	7005723							108	U	89.33		72.14							
4-Bromophenyl-Phenylether	µg/kg	101553							108	U	89.05		73.89							
4-Methyl-2-pentanone	µg/kg	108101	0.95	J	73		75													
4-Methylphenol	µg/kg	106445							108	U	89.89		64.83							
9H-Fluorene	µg/kg	86737							108	U	88.91		71.4							
Acenaphthene	µg/kg	83329							108	U	88.25		68.12							
Acenaphthylene	µg/kg	208968							108	U	89.23		67.96							
Acetone	µg/kg	67641	51.3	U		NAR	NAR													
Alachlor	µg/kg	15972608	78	U																
Aldrin	µg/kg	309002	9.75	U	74		69													
Alpha-BHC	µg/kg	319846	9.75	U	75		65													
Aniline	µg/kg	62533							108	U										
Anthracene	µg/kg	120127							108	U	74.4		61.29							
Atrazine	µg/kg	1912249	32.5	U																
Azinphos-ethyl	µg/kg	2642719	52	U																
Azinphos-methyl	µg/kg	86500	52	U																
Benzene	µg/kg	71432	3.5	U	100.82		92.2													
Benzo [b] fluoranthene	µg/kg	205992							108	U	92.3		76.78							
Benzo(a)anthracene	µg/kg	56553							108	U	92.18		76.52							
Benzo(a)pyrene	µg/kg	50328							108	U	86.14		71.99							

Station Number			10	10	10	11	11	11	12A	12A	12A
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Benzo(g,h,i)perylene	µg/kg	191242				108 U	90.66	75.27			
Benzoic acid	µg/kg	65850				1080 UJ	51.25	49.07			
Benzonitrile, 2,6-dichlo	µg/kg	1194656	39 U								
Benzo[k]fluoranthene	µg/kg	207089				108 U	90.04	74.41			
Benzyl alcohol	µg/kg	100516				108 U	90.49	57.01			
Beta-BHC	µg/kg	319857	9.75 U	87	81						
bis(2-Chloroisopropyl)ether	µg/kg	39638329				108 UJ	90.29	49.52			
bis(2-Chloroethyl)ether	µg/kg	111444				108 UJ	85.52	43.53			
bis(2-Chloroethoxy)methane	µg/kg	111911				108 U	90.32	56.76			
Bis(2-ethylhexyl) phthal	µg/kg	117817				108 U	95	80			
Bromacil	µg/kg	314409	195 U								
Bromobenzene	µg/kg	108861	3.5 U	84.45	81.74						
Bromochloromethane	µg/kg	74975	3.5 U	114.35	98.16						
Bromodichloromethane	µg/kg	75274	3.5 U	50.24	60.24						
Bromoform	µg/kg	75252	3.5 UJ	32.69	48.78						
Bromomethane	µg/kg	74839	3.5 U	81.61	75.12						
Butylbenzylphthalate	µg/kg	85687				108 U	92.17	78			
Butyltin trichloride	µg/kg	1118463							10.7 U	1380 J	1280 J
Carbon Tetrachloride	µg/kg	56235	3.5 U	67.11	71.67						
Carbophenothion	µg/kg	786196	32.5 U								
Chlordane (Tech)	µg/kg	57749	130 U								
Chlorobenzene	µg/kg	108907	3.5 U	84.37	80.54						
Chloroethane	µg/kg	75003	3.5 U	102.03	91.37						
Chloroform	µg/kg	67663	3.5 U	99	85						
Chloromethane	µg/kg	74873	3.5 U	89.92	85.33						
Chlorpropham (CIPC)	µg/kg	101213	163 U								
Chlorpyrifos-ethyl	µg/kg	5598130	22.8 U								
Chrysene	µg/kg	218019				108 U	94.73	76.75			
cis-1,2-Dichloroethene	µg/kg	156592	3.5 U	92.27	87.08						
Cis-1,3-Dichloropropene	µg/kg	10061015	3.7 UJ	49.38	58.93						
Coumaphos	µg/kg	56724	39 U								
Dalapon	µg/kg	75990									
DCPA (dacthal)	µg/kg	18611321									

Station Number			10		10		10		11		11		11		12A		12A		12A	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
DCPA	µg/kg	1861321																		
Delta-BHC	µg/kg	319868	9.75	U	85		83													
Demeton-0	µg/kg	298033	22.8	U																
Demeton-s	µg/kg	126750	22.8	U																
Di-n-octylphthalate	µg/kg	117840							108	U	96.79		81.26							
Di-n-Butylphthalate	µg/kg	84742							108	U	97		239.72							
Diazinon	µg/kg	333415	26	U																
Dibenzofuran	µg/kg	132649							108	U	87.63		71.19							
Dibenz[a,h]anthracene	µg/kg	53703							108	U	92.65		77.5							
Dibromochloromethane	µg/kg	124481	3.5	UJ	38.87		52.54													
Dibromomethane	µg/kg	74953	3.5	U	111.76		95.02													
Dibutyltin dichloride	µg/kg	683181													10.8	U	237	J	169	J
Dicamba	µg/kg	1918009																		
Dichlorobenzoic Acid	µg/kg																			
Dichlorodifluoromethane	µg/kg	75718	3.5	U	62.49		57.25													
Dichloroprop	µg/kg	120365																		
Diclofop-methyl	µg/kg	51338273																		
Dieldrin	µg/kg	60571	19.5	U	80		82													
Diethyl phthalate	µg/kg	84662							108	U	97.15		80.73							
Dimethoate	µg/kg	60515	26	U																
Dimethylphthalate	µg/kg	131113							108	U	92.28		76.57							
Diphenamid	µg/kg	957517	97.5	U																
Disulfoton	µg/kg	298044	19.5	U																
Endosulfan II	µg/kg	33213659	19.5	U	86		83													
Endosulfan Sulfate	µg/kg	1031078	19.5	U	79		78													
Endosulfan I	µg/kg	959988	9.75	U	92		83													
Endrin	µg/kg	72208	19.5	U	90		87													
Endrin Aldehyde	µg/kg	7421934	19.5	U	68		62													
Endrin Ketone	µg/kg	53494705	19.5	U	76		73													
EPN	µg/kg	2104645	32.5	U																
Ethalfuralin (Sonalan)	µg/kg	55283686	48.8	U																
Ethane, 1,1,2,2-tetrachl	µg/kg	79345	3.5	U	110.13		107.45													
Ethion	µg/kg	563122	22.8	U																

Station Number			10	10	10	11	11	11	12A	12A	12A
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Ethoprop	µg/kg	13194484	26 U								
Ethylbenzene	µg/kg	100414	3.5 U	84.42	78.63						
Fenithrothion	µg/kg	122145	22.8 U								
Fensulfothion	µg/kg	115902	32.5 U								
Fenthion	µg/kg	55389	22.8 U								
Fluoranthene	µg/kg	206440				108 U	95.91	76.65			
Fluridone	µg/kg	59756604	260 U								
Fonophos	µg/kg	944229	19.5 U								
Heptachlor	µg/kg	76448	9.75 U	80	67						
Heptachlor Epoxide	µg/kg	1024573	9.75 U	86	81						
Hexachlorobenzene	µg/kg	118741				108 U	92.29	75.13			
Hexachlorobutadiene	µg/kg	87683	3.5 U	71.09	70.05	108 UJ	75.9	39.61			
Hexachloroethane	µg/kg	67721				108 UJ	62.29	31			
Imidan	µg/kg	732116	35.8 U								
Indeno(1,2,3-cd)pyrene	µg/kg	193395				108 U	93.2	78.97			
Ioxynil	µg/kg	1689834									
Isophorone	µg/kg	78591				108 U	90.73	61.21			
Isopropylbenzene	µg/kg	98828	3.5 U	91.9	87.27						
Lindane	µg/kg	58899	9.75 U	81	71						
Malathion E50	µg/kg	121755	26 U								
Mercury Methyl	µg/kg	115093							5.76 UJ	109.25 J	NA R
Merphos	µg/kg	150505	52 U								
Metholachlor	µg/kg	51218452	97.5 U								
Methomyl	µg/kg	16752775									
Methoxychlor	µg/kg	72435	19.5 U	78	86						
Methylene Chloride	µg/kg	75092	3.5 U	120.99	108.83						
Metribuzin	µg/kg	21087649	32.5 U								
MP-Xylene	µg/kg		7 U	160.53	152.09						
n-Nitrosodiphenylamine	µg/kg	86306				108 U					
n-Nitrosodimethylamine	µg/kg	62759				108 U					
n-Butylbenzene	µg/kg	104518	3.5 U	69.23	64.65						
n-Propylbenzene	µg/kg	103651	3.5 U	83.17	78.55						

Station Number			10	10	10	11	11	11	12A	12A	12A
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
N-Nitrosodipropylamine	µg/kg	621647				108	U	93.34	56.14		
Naphthalene	µg/kg	91203	17.5	U	65.28	78.53	108	UJ	79.29	43.7	
Naphthalene, 2-methyl-	µg/kg	91576					108	U	81.08	53.22	
Napropamide	µg/kg	15299997	97.5	U							
Nitrobenzene	µg/kg	98953					108	U	90.21	49.95	
Norflurazon	µg/kg	27314132	48.8	U							
o-Xylene	µg/kg	95476	3.5	U	85.09	80.86					
Oxyfluorfen	µg/kg	42874033	84.5	U							
p-Isopropyltoluene	µg/kg	99876	3.5	U	80.11	76.56					
P,P'-DDE	µg/kg	72559	19.5	U	86	82					
P,P'-DDT	µg/kg	50293	19.5	U	72	82					
P,P'-DDD	µg/kg	72548	19.5	U	90	88					
Parathion	µg/kg	56382	26	U							
Parathion-methyl	µg/kg	298000	22.8	U							
Pendimethalin	µg/kg	40487421	48.8	U							
Pentachlorophenol	µg/kg	87865					108	U	77.13	62.95	
Phenanthrene	µg/kg	85018					108	U	89.51	72.19	
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513									
Phenol	µg/kg	108952					108	U	89.43	58.53	
Phorate	µg/kg	298022	22.8	U							
Prometryne	µg/kg	7287196	32.5	U							
Pronamide (kerb)	µg/kg	23950585	97.5	U							
Pyrene	µg/kg	129000					108	U	88.1	72.71	
Ramrod	µg/kg	1918167	65	U							
Ronnel	µg/kg	299843	22.8	U							
sec-Butylbenzene	µg/kg	135988	3.5	U	87.87	82.9					
Simazine	µg/kg	122349	32.5	U							
Styrene	µg/kg	100425	3.5	U	69.97	68.98					
Sulfotep	µg/kg	3689245	19.5	U							
Sulprofos	µg/kg	35400432	22.8	U							
Tebuthiuron	µg/kg	34014181	32.5	U							
Terbacil	µg/kg	5902512	163	U							
Tert-butylbenzene	µg/kg	98066	3.5	U	93.58	88.82					

Station Number			10		10		10		11		11		11		12A		12A		12A	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Tetrabutyltin	µg/kg	1461252													11.3	U	65	J	48	J
Tetrachloroethene	µg/kg	127184	3.5	U	76.53		72.41													
Toluene	µg/kg	108883	3.5	U	90.21		83.68													
Total Xylenes	µg/kg	1330207	10.5	U	0		0													
Toxaphene	µg/kg	8001352	390	U																
trans-1,2-Dichloroethene	µg/kg	156605	3.5	U	91.67		85.52													
Trans-1,3-Dichloropropene	µg/kg	10061026	3.3	UJ	38.92		50.56													
Tributyltin chloride	µg/kg	1461229													11.6	U	125	J	117	J
Trichloroethene	µg/kg	79016	3.5	U	74.26		69.99													
Trichlorofluoromethane	µg/kg	75694	3.5	U	76.81		68.94													
Trifluraline	µg/kg	1582098	48.8	U																
Vinyl Chloride	µg/kg	75014	3.5	U	93.73		85.91													

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-4. MS/MSD Organics Measurements of Tideflat Samples 13 and 14.

Station Number			13	13	13	14	14	14
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
SAMPLE NUMBER			94334304-0	94334304-S1	94334304-S2	94334300-0	94334300-S1	94334300-S2
1-Naphthol	µg/kg	90153				4.882	U	NAR
1,2-Dibromo-3-chloropropane	µg/kg	96128				2.3	U	76
1,2-Dibromoethane	µg/kg	106934				2.3	U	86
2,4-D	µg/kg	94757	61	U	101			87
2,4,5-T	µg/kg	93765	48	U	95			88
2,4,5-TB	µg/kg	93801	55	U	104			84
2,4,5-Trichlorophenol	µg/kg	95954	35	U	60			54
2,4,6-Trichlorophenol	µg/kg	88062	36	U	66			53
2,4-DB	µg/kg	94826	73	U	102			83
3,5-Dichlorobenzoic acid	µg/kg	51365	59	U	87			68
4-Nitrophenol	µg/kg	100027	104	U	78			51
5-Hydroxydicamba	µg/kg	7600502	60	U	55			50
Acifluorfen	µg/kg	50594666	248	U	33			25
Alachlor	µg/kg	15972608				66.5	U	88
Aldicarb sulfoxide	µg/kg	1646873				2.441	U	54.5
Aldicarb	µg/kg	116063				2.441	U	54.9
Aldrin	µg/kg	309002				8.31	U	
Alpha-BHC	µg/kg	319846				8.31	U	
Atrazine	µg/kg	1912249				27.7	U	68
Azinphos-methyl	µg/kg	86500				44.3	U	
Azinphos-ethyl	µg/kg	2642719				44.3	U	
Bentazon	µg/kg	25057890	91	U	83			66
Benzoic acid, 3-amino-2,	µg/kg	133904	60	U	17			14
Benzonitrile, 2,6-dichlo	µg/kg	1194656				33.3	U	73
Bromacil	µg/kg	314409				166	U	62
Bromoxynil	µg/kg	1689845	10	J	42			34
Butyltin trichloride	µg/kg	1118463				4.6	U	131.61
Carbaryl	µg/kg	63252				2.441	U	47.2
Carbofuran	µg/kg	1563662				2.441	U	51.1
Carbophenothion	µg/kg	786196				27.7	U	
Chlordane (Tech)	µg/kg	57749				111	U	
Chlorpropham (CIPC)	µg/kg	101213				139	U	
Chlorpyrifos-ethyl	µg/kg	5598130				19.4	U	
Coumaphos	µg/kg	56724				33.3	U	
Dalapon	µg/kg	75990	165	U	32			32
DCPA	µg/kg	1861321	47	U	105			77
Delta-BHC	µg/kg	319868				8.31	U	
Demeton-s	µg/kg	126750				19.4	U	
Demeton-O	µg/kg	298033				19.4	U	
Diazinon	µg/kg	333415				22.2	U	
Dibutyltin dichloride	µg/kg	683181				9.3	U	157.56
Dicamba	µg/kg	1918009	60	U	93			77
Dichlorobenzoic Acid	µg/kg		59	R	0			0
Dichloroprop	µg/kg	120365	67	U	99			81
Diclofop-methyl	µg/kg	51338273	96	U	93			83
Dieldrin	µg/kg	60571				16.6	U	
Dimethoate	µg/kg	60515				22.2	U	
Dinoseb	µg/kg	88857	91	R	0			0

Station Number			13	13	13	14	14	14
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)	Matrix Spike Duplicate (MSD)	Field Sample	Matrix Spike (MS)	Matrix Spike Duplicate (MSD)
Diphenamid	µg/kg	957517				83.1	U	48
Disulfoton	µg/kg	298044				16.6	U	
Endosulfan II	µg/kg	33213659				16.6	U	
Endosulfan Sulfate	µg/kg	1031078				16.6	U	
Endosulfan I	µg/kg	959988				8.31	U	
Endrin Ketone	µg/kg	53494705				16.6	U	
Endrin	µg/kg	72208				16.6	U	
Endrin Aldehyde	µg/kg	7421934				16.6	U	
EPN	µg/kg	2104645				27.7	U	
Ethalfuralin (Sonalan)	µg/kg	55283686				41.6	U	61
Ethion	µg/kg	563122				19.4	U	
Ethoprop	µg/kg	13194484				22.2	U	
Fenithrothion	µg/kg	122145				19.4	U	
Fensulfothion	µg/kg	115902				27.7	U	
Fenthion	µg/kg	55389				19.4	U	
Fluridone	µg/kg	59756604				222	U	20
Fonophos	µg/kg	944229				16.6	U	
Heptachlor Epoxide	µg/kg	1024573				8.31	U	
Heptachlor	µg/kg	76448				8.31	U	
Imidan	µg/kg	732116				30.5	U	
Ioxynil	µg/kg	1689834	44	J	28			30
Lindane	µg/kg	58899				8.31	U	
Malathion E50	µg/kg	121755				22.2	U	
MCPA	µg/kg	94746	120	U	89			80
MCPP	µg/kg	93652	123	U	90			78
Mercaptodimethur	µg/kg	2032657				488.2	U	46.4
Mercury Methyl	µg/kg	115093				110	U	86
Merphos	µg/kg	150505				44.3	U	
Metholachlor	µg/kg	51218452				83.1	U	79
Methomyl	µg/kg	16752775				2.441	U	53.1
Methoxychlor	µg/kg	72435				16.6	U	
Metribuzin	µg/kg	21087649				27.7	U	55
Napropamide	µg/kg	15299997				83.1	U	74
Norflurazon	µg/kg	27314132				41.6	U	47
Oxyfluorfen	µg/kg	42874033				72.1	U	75
Pendimethalin	µg/kg	40487421				41.6	U	81
Pentachlorophenol	µg/kg	87865	30	U	67			40
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	33	U	73			55
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	33	U	80			68
Phorate	µg/kg	298022				19.4	U	
Picloram	µg/kg	1918021	61	U	87			75
Prometryne	µg/kg	7287196				27.7	U	97
Pronamide (kerb)	µg/kg	23950585				83.1	U	35
Propoxur	µg/kg	114261				2.441	U	51.5
Ramrod	µg/kg	1918167				55.4	U	72
Ronnel	µg/kg	299843				19.4	U	
Silvex	µg/kg	93721	48	U	93			79
Simazine	µg/kg	122349				27.7	U	66
Sulfotep	µg/kg	3689245				16.6	U	
Sulprofos	µg/kg	35400432				19.4	U	

Station Number			13	13	13	14	14	14
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Tebuthiuron	µg/kg	34014181				27.7	U	65
Terbacil	µg/kg	5902512				139	U	70
Tetrabutyltin	µg/kg	1461252				4.8	UJ	50.57
Toxaphene	µg/kg	8001352				333	U	
Tributyltin chloride	µg/kg	1461229				5	U	186.69
Trichlopyr	µg/kg	55335063	49	U	99	83		
Trifluraline	µg/kg	1582098				41.6	U	63
Vydate	µg/kg	23135220				2.441	U	67.9

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-5. MS/MSD Organics Measurements of Samples 2 and 23.

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Sample Number			95080026-0	95080026-S1	95080026-S2	95080020-0	95080020-S1	95080020-S2	95080020-S3	95080020-S4
1,4-Dichlorobenzene	µg/kg	106467	0.28 U	60.24	64.12	2.2 U	66.19	83.78		
1,3-Dinitrobenzene	µg/kg	99650	2 U	105	64	469.7 U	125	105	NAR	NAR
1-Naphthol	µg/kg	90153	0.5 U	4.85	6.075					
1,2-Diphenylhydrazine	µg/kg	122667	0.28 U	82.03	82.37	125 U	88.3	86.85		
1,2,3-Trichloropropane	µg/kg	96184				2.2 U	95.2	112.9		
1,2-Dibromo-3-chloropropane	µg/kg	96128				2.2 UJ	60.54	56.66		
1,2,4-Trimethylbenzene	µg/kg	95636				2.2 U	83.84	102.8		
1,2-Dichlorobenzene	µg/kg	95501	0.28 U	59.87	63.59	2.2 U	67.12	84.34		
1,2,3-Trichlorobenzene	µg/kg	87616				2.2 UJ	25.5	30.32		
1,1,2-Trichloroethane	µg/kg	79005				2.2 U	97.3	114.6		
1,2-Dichloropropane	µg/kg	78875				2.2 U	95.72	109.6		
1,1-dichloroethene	µg/kg	75354				2.2 U	113.3	123		
1,1-Dichloroethane	µg/kg	75343				2.2 U	96.05	109.5		
1,1,1-Trichloroethane	µg/kg	71556				2.2 U	94.08	105.6		
1,1,1,2-Tetrachloroethane	µg/kg	630206				2.2 UJ	46.7	37.62		
1,1-Dichloropropene	µg/kg	563586				2.2 U	90.95	98.99		
1,3-Dichlorobenzene	µg/kg	541731	0.28 U	57.52	62.35	2.2 U	70.44	86.16		
1,3-Dichloropropane	µg/kg	142289				2.2 U	79.79	97.78		
1,2,4-Trichlorobenzene	µg/kg	120821	0.28 U	58.55	60.34	2.2 UJ	31.74	36.25		
1,3,5-Trimethylbenzene	µg/kg	108678				2.2 U	86.21	106.4		
1,2-Dichloroethane	µg/kg	107062				2.2 U	85.73	104.5		
1,2-Dibromoethane	µg/kg	106934				2.2 U	60.99	67.79		
2-Nitrotoluene	µg/kg	88722	2 U	61	16	281.8 U	NAR	NAR	43	32
2-Chlorotoluene	µg/kg	95498				2.2 U	83.59	100.6		
2,4,5-Trichlorophenol	µg/kg	95954	0.28 U	91.54	95.35	125 U	90.67	89.83		
2-Chlorophenol	µg/kg	95578	0.28 U	79.49	88.99	125 U	89.84	81.52		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
2-Methylphenol	µg/kg	95487	0.28 U	79.64	90.85	125 U	90.59	85.64		
2-Chloronaphthalene	µg/kg	91587	0.28 U	68.87	70.11	125 U	86.05	82.58		
2-Nitrophenol	µg/kg	88755	0.57 U	88.9	95.11 J	626 U	58.5 J	62.21 J		
2-Nitroaniline	µg/kg	88744	2.8 U	94.24	102.93	626 U	84.74	93.48		
2,4,6-Trichlorophenol	µg/kg	88062	0.28 U	91.74	97.7	250 U	92.96	92.8		
2-Hexanone	µg/kg	591786				11.1 UJ	35.17 J	48.25		
2,6-Dinitrotoluene	µg/kg	606202	2 U	70	28	281.8 U	68.95 NAR	76.22 NAR	71	54
2,2-Dichloropropane	µg/kg	594207				2.2 U	89.19	107.1		
2-Butanone	µg/kg	78933				24.8 U	NAR	NAR		
2,4-Dinitrophenol	µg/kg	51285	5.7 U	149.82 J	134.2 J	5010 UJ	72.32 J	45.86 J		
2,4-Dinitrotoluene	µg/kg	121142	2 U	78	36	281.8 U	129	103	NAR	NAR
2,4-Dichlorophenol	µg/kg	120832	0.28 U	82.45	90.21	125 U	92.77	91.54		
2,4-Dimethylphenol	µg/kg	105679	0.28 U	82	89.07	125 U	102.1	108.1		
3-Nitroaniline	µg/kg	99092	1.4 U	96.83	98.17	626 UJ	12.95	19.33		
3-OH-Carbofuran	µg/kg	16655826	0.5 U	4.625 U	5.875 U					
4-Nitrophenol	µg/kg	100027	2.8 U	66.07	69.34	1250 U	105.6 J	103.6 J		
4-Bromophenyl-Phenylether	µg/kg	101553	0.28 U	80.7	78.86	125 U	92.1	90.49		
4-Methylphenol	µg/kg	106445	0.28 U	78.15	86.61	54.6 J	92.49	89.43		
4,6-Dinitro-2-methylphenol	µg/kg	534521	5.7 U	119.54	116.36	2500 UJ	63.18	41.49		
4-Nitroaniline	µg/kg	100016	0.57 U	71.5 J	64.85 J	626 UJ	17.46	32.07		
4-Chloro-3-methylphenol	µg/kg	59507	0.28 U	88.84	93.81	125 U	93.45	93.94		
4-Chlorophenyl-Phenylether	µg/kg	7005723	0.28 U	76.98	74.33	125 U	89.9	89.67		
4-Nitrotoluene	µg/kg	99990	2 U	61	17	281.8 U	NAR	NAR	45	32
4-Methyl-2-pentanone	µg/kg	108101				2.2 UJ	28.26	68.45		
4-Chlorotoluene	µg/kg	106434				2.2 U	71.39	92.7		
9H-Fluorene	µg/kg	86737	0.28 U	84.99	84.53	125 U	91.76	90.5		
Acenaphthene	µg/kg	83329	0.017 J	79.45	78.21	125 U	87.16	86.38		
Acenaphthylene	µg/kg	208968	0.28 U	81.86	80.89	125 U	89.34	88.45		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Acetone	µg/kg	67641				31.3 U	NAR	NAR		
Alachlor	µg/kg	15972608				265 U	95	110		
Aldicarb sulfoxide	µg/kg	1646873	0.5 U	4.625 U	4.675 U					
Aldicarb	µg/kg	116063	0.5 U	5.875 U	9.225 U					
Aldrin	µg/kg	309002				23 U	119	105		
Alpha-BHC	µg/kg	319846				23 U	104	102		
Aniline	µg/kg	62533	0.28 U	73.74	80.62	R	1.24	10.73		
Anthracene	µg/kg	120127	0.28 U	91.96	92.02	125 U	90.74	91.54		
Atrazine	µg/Kg	19312249				74 U	89	93		
Azinphos-methyl	µg/kg	86500				118 UJ	NAR	NAR		
Azinphos-ethyl	µg/kg	2642719				118 UJ	27	28		
Benzene, Trinitro-	µg/kg	99354	2 U	67	42	469.7 U	172	157	NAR	NAR
Benzene	µg/kg	71432				2.2 U	95.48	109.1		
Benzene, 2-methyl-1,3,5-trinitro-	µg/kg	118967	2 U	116	65	469.7 U	104	75	NAR	NAR
Benzene, 1-methyl-3-nitr	µg/kg	99081	2 U	59	17	281.8 U	NAR	NAR	38	33
Benzo [b] fluoranthene	µg/kg	205992	0.28 U	98	103.23	125 U	94.99	94.97		
Benzo(a)anthracene	µg/kg	56553	0.28 U	98.41	100.47	125 U	91.99	88.17		
Benzo(a)pyrene	µg/kg	50328	0.28 U	100.03	100.6	125 U	86.02	87.98		
Benzo(g,h,i)perylene	µg/kg	191242	0.28 U	101.33	103.49	125 U	71.85	80.61		
Benzoic acid	µg/kg	65850	5.7 UJ	12.82	52.05	2500 U	105.3 J	116.2 J		
Benzonitrile, 2,6-dichlo	µg/kg	1194656				147 U	97	95		
Benzo[k]fluoranthene	µg/kg	207089	0.28 U	95.49	99.01	125 U	92.1	94.79		
Benzyl alcohol	µg/kg	100516	0.28 U	75.03	83.02	125 U	84.85	87.88		
Beta-BHC	µg/kg	319857				23 U	74	74		
bis(2-Chloroisopropyl)ether	µg/kg	39638329	0.28 U	71.94	81.66	125 U	85.98	70.27		
bis(2-Chloroethoxy)methane	µg/kg	111911	0.28 U	77.65	85.95	125 U	83.7	79.11		
bis(2-Chloroethyl)ether	µg/kg	111444	0.28 U	77.75	87.69	125 U	85.2	68.33		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Bis(2-ethylhexyl) phthal	µg/kg	117817	0.28 U	292.13	101.15	626 U	101.6	95.96		
Bromacil	µg/kg	314409				295 U	115	62		
Bromobenzene	µg/kg	108861				2.2 U	75.42	91.38		
Bromochloromethane	µg/kg	74975				2.2 U	124.8	124.5		
Bromodichloromethane	µg/kg	75274				2.2 UJ	14.97	16.57		
Bromoform	µg/kg	75252				R	4.1	1.72		
Bromomethane	µg/kg	74839				4.4 UJ	47.67 J	69.29		
Butylbenzylphthalate	µg/kg	85687	0.28 U	99.13	106.07	626 U	104.6	97.48		
Carbaryl	µg/kg	63252	0.5 U	4.675 U	6.65 U					
Carbofuran	µg/kg	1563662	0.5 U	5.9 U	6.925 U					
Carbon Tetrachloride	µg/kg	56235				2.2 UJ	59.51	48.99		
Carbophenothion	µg/kg	786196				74 U	61	62		
Chlordane (Tech)	µg/kg	57749				313 U	108	105		
Chlorobenzene	µg/kg	108907				2.2 U	74.24	90.33		
Chloroethane	µg/kg	75003				2.2 U	104.5	113.4		
Chloroform	µg/kg	67663				0.6 J	94.75	103.8		
Chloromethane	µg/kg	74873				2.2 U	126	128.5		
Chlorpropham (CIPC)	µg/kg	101213				295 U	NAR	NAR		
Chlorpyrifos-ethyl	µg/kg	5598130				59 U	67	89		
Chrysene	µg/kg	218019	0.28 U	97.79	101.65	125 U	105	99.55		
cis-1,2-Dichloroethene	µg/kg	156592				2.2 U	87.85	97.83		
Cis-1,3-Dichloropropene	µg/kg	10061015				R	11.8	9.9		
Coumaphos	µg/kg	56724				88 UJ	NAR	NAR		
Delta-BHC	µg/kg	319868				23 U	78	73		
Demeton-s	µg/kg	126750				103 UJ	116	117		
Demeton-0	µg/kg	298033				103 UJ	39	47		
Di-n-Butylphthalate	µg/kg	84742	0.075 J	93.55	96.31	856 U	93.68	83.01		
Di-n-octylphthalate	µg/kg	117840	1.4 U	98.53	99.6	626 U	92.4	90.64		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Diazinon	µg/kg	333415				59 UJ	NAR	NAR		
Dibenzofuran	µg/kg	132649	0.01 J	86.23	86.98	125 U	86.96	89.8		
Dibenz[a,h]anthracene	µg/kg	53703	0.28 U	102.04	103.23	125 U	88.05 J	88.08 J		
Dibromochloromethane	µg/kg	124481				R	7.76	5.13		
Dibromomethane	µg/kg	74953				2.2 U	123.8	127.3		
Dichlorodifluoromethane	µg/kg	75718				2.2 U	95.08	104		
Dieldrin	µg/kg	60571				47 U	116	104		
Diethyl phthalate	µg/kg	84662	0.28 U	98.26	101.85	125 U	93.76	91.72		
Dimethoate	µg/kg	60515				59 UJ	NAR	NAR		
Dimethylphthalate	µg/kg	131113	0.28 U	96.15	98.59	125 U	92.5	90.89		
Diphenamid	µg/kg	957517				221 U	53	63		
Disulfoton	µg/kg	298044				44 UJ	63	65		
Endosulfan II	µg/kg	33213659				47 U	103	105		
Endosulfan Sulfate	µg/kg	1031078				47 U	93	79		
Endosulfan I	µg/kg	959988				23 U	103	88		
Endrin Ketone	µg/kg	53494705				47 UJ	92	73		
Endrin	µg/kg	72208				47 U	116	99		
Endrin Aldehyde	µg/kg	7421934				47 UJ	77	59		
EPN	µg/kg	2104645				74 U	56	65		
Ethalfuralin (Sonalan)	µg/kg	55283686				111 U	95	99		
Ethane, 1,1,2,2-tetrachl	µg/kg	79345				2.2 UJ	85.58 J	114.3		
Ethion	µg/kg	563122				52 U	53	54		
Ethoprop	µg/kg	13194484				59 U	NAR	NAR		
Ethylbenzene	µg/kg	100414				2.2 U	76.82	96.42		
Fenithrothion	µg/kg	122145				52 U	53	61		
Fensulfothion	µg/kg	115902				118 U	NAR	NAR		
Fenthion	µg/kg	55389				52 U	NAR	NAR		
Fluoranthene	µg/kg	206440	0.01 J	93.72	96.73	44.1 J	86.94	85.89		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Fluridone	µg/kg	59756604				442 UJ	11	7		
Fonophos	µg/kg	944229				44 U	63	63		
Heptachlor Epoxide	µg/kg	1024573				23 U	82	82		
Heptachlor	µg/kg	76448				23 U	99	91		
Hexachlorobenzene	µg/kg	118741	0.28 U	91.61	92.28	125 U	89	88.8		
Hexachlorobutadiene	µg/kg	87683	0.28 U	52.69	55.68	2.2 U	51.22	53.34		
Hexachloroethane	µg/kg	67721	0.28 U	53.66	58.26	R	8.89	3.59		
Imidan	µg/kg	732116				81 UJ	NAR	NAR		
Indeno(1,2,3-cd)pyrene	µg/kg	193395	0.28 U	104.31	108.95	125 U	85.77 J	88.49 J		
Isophorone	µg/kg	78591	0.28 U	80.92	91.66	125 U	85.95	80.37		
Isopropylbenzene	µg/kg	98828				2.2 U	96.36	113.4		
Lindane	µg/kg	58899				23 U	101	95		
Malathion E50	µg/kg	121755				59 U	36	49		
Mercaptodimethur	µg/kg	2032657	1 U	9.125	12.4 U					
Merphos	µg/kg	150505				88 UJ	11	15		
Metholachlor	µg/kg	51218452				295 U	81	88		
Methomyl	µg/kg	16752775	0.5 U	4	4.425 U					
Methoxychlor	µg/kg	72435				47 U	66	352		
Methyl Chlorpyrifos	µg/Kg					59 U	56	50		
Methylene Chloride	µg/kg	75092				11.1 U	98.18	107		
Metribuzin	µg/kg	21087649				74 U	57	65		
MP-Xylene	µg/kg					4.4 U	73.8	93.5		
n-Propylbenzene	µg/kg	103651				2.2 U	83.95	101.6		
n-Butylbenzene	µg/kg	104518				2.2 UJ	47.58	72.5		
n-Nitrosodimethylamine	µg/kg	62759	0.28 U	90.67	89.82	626 UJ	69.52	42.93		
n-Nitrosodiphenylamine	µg/kg	86306	0.28 U	92.37	92.92	125 U	92.37	91.02		
N-Nitrosodinpropylamine	µg/kg	621647	0.28 U	82.22	92.22	125 U	97.8	84.96		
Naphthalene, 2-methyl-	µg/kg	91576	0.28 U	72.97	79.54	125 U	81.29	81.71		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Naphthalene	µg/kg	91203	0.28 U	67.75	71.5	2.2 UJ	32.81	41.16		
Napropamide	µg/kg	15299997				221 U	78	82		
Nitrobenzene	µg/kg	98953	0.28 NAR	76	31	469.7 U	119	92	NAR	NAR
Norflurazon	µg/kg	27314132				147 UJ	33	26		
o-Xylene	µg/kg	95476				2.2 U	74.85	96.07		
Oxyfluorfen	µg/kg	42874033				147 U	85	88		
p-Isopropyltoluene	µg/kg	99876				2.2 U	74.06	95.66		
P,P'-DDT	µg/kg	50293				47 UJ	78	70		
P,P'-DDD	µg/kg	72548				47 UJ	90	84		
P,P'-DDE	µg/kg	72559				47 UJ	95	90		
Parathion-methyl	µg/kg	298000				52 U	NAR	NAR		
Parathion	µg/kg	56382				59 U	NAR	NAR		
Pendimethalin	µg/kg	40487421				111 U	146	130		
Pentachlorophenol	µg/kg	87865	2.8 U	103.61	106.71	1250 U	91.81	86.57		
Phenanthrene	µg/kg	85018	0.28 U	88.11	87.34	125 U	89.22	88.43		
Phenol	µg/kg	108952	0.28 U	66.41	77.06	125 U	92.04	83.45		
Phorate	µg/kg	298022				52 U	NAR	NAR		
Picloram	µg/kg	1918021								
Prometryne	µg/kg	7287196				74 U	75	68		
Pronamide (kerb)	µg/kg	23950585				295 U	110	119		
Propoxur	µg/kg	114261	0.5 U	5.05	5.475	U				
Pyrene	µg/kg	129000	0.28 U	95.77	97.6	125 U	101.5	98.17		
Ramrod	µg/kg	1918167				177 U	80	84		
Ronnel	µg/kg	299843				52 U	NAR	NAR		
sec-Butylbenzene	µg/kg	135988				2.2 U	87.74	103.9		
Simazine	µg/kg	122349				74 UJ	71	70		
Styrene	µg/kg	100425				2.2 UJ	27.21	48.03		
Sulfotep	µg/kg	3689245				44 U	69	68		

STATION NUMBER			2	2	2	23	23	23	23	23
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Sulprofos	µg/kg	35400432				52 U	NAR	NAR		
Tebuthiuron	µg/kg	34014181				111 U	103	95		
Terbacil	µg/kg	5902512				221 U	133	140		
Tert-butylbenzene	µg/kg	98066				2.2 U	106.6	113.9		
Tetrachloroethene	µg/kg	127184				2.2 U	78.03	93.6		
Tetryl	µg/kg	479458	2	U	166	57	469.7 U	NAR	NAR	NAR
Toluene	µg/kg	108883				2.2 U	80.38	99.13		
Total Xylenes	µg/kg	1330207				4.4 U	74.2	94.3		
Toxaphene	µg/kg	8001352				939 U	NAR	NAR		
trans-1,2-Dichloroethene	µg/kg	156605				2.2 U	87.5	96.7		
Trans-1,3-Dichloropropene	µg/kg	10061026				R	10.6	9.6		
Trichloroethene	µg/kg	79016				2.2 U	71.94	85.87		
Trichlorofluoromethane	µg/kg	75694				2.2 U	100.6	101.1		
Trifluraline	µg/kg	1582098				111 U	142	147		
Vinyl Chloride	µg/kg	75014				2.2 U	101.4	115.4		
Vydate	µg/kg	23135220	0.5	U	3.85	U	3.975	U		

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-6. MS/MSD Organics Measurements of Samples 4 and 5.

STATION NUMBER			4	4	4	5	5	5
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Sample Number			95080024-0	95080024-S1	95080024-S2	95080021-0	95080021-S1	95080021-S2
1,4-Dichlorobenzene	µg/kg	106467	1 U	101	103			
1-Naphthol	µg/kg	90153				6.3 U	44	54
1,2,3-Trichloropropane	µg/kg	96184	1 U	100	104			
1,2-Dibromo-3-chloropropane	µg/kg	96128	1 U	87	83			
1,2,4-Trimethylbenzene	µg/kg	95636	1 U	100	98			
1,2-Dichlorobenzene	µg/kg	95501	1 U	105	102			
1,2,3-Trichlorobenzene	µg/kg	87616	1 U	77	80			
1,1,2-Trichloroethane	µg/kg	79005	1 U	102	101			
1,2-Dichloropropane	µg/kg	78875	1 U	106	101			
1,1-dichloroethene	µg/kg	75354	1 U	117	104			
1,1-Dichloroethane	µg/kg	75343	1 U	104	98			
1,1,1-Trichloroethane	µg/kg	71556	1 U	98	95			
1,1,1,2-Tetrachloroethane	µg/kg	630206	1 U	95	96			
1,1-Dichloropropene	µg/kg	563586	1 U	102	98			
1,3-Dichlorobenzene	µg/kg	541731	1 U	103	101			
1,3-Dichloropropane	µg/kg	142289	1 U	102	101			
1,2,4-Trichlorobenzene	µg/kg	120821	1 U	83	84			
1,3,5-Trimethylbenzene	µg/kg	108678	1 U	101	102			
1,2-Dichloroethane	µg/kg	107062	1 U	104	100			
1,2-Dibromoethane	µg/kg	106934	1 U	99	98			
2,4-D	µg/kg	94757	0.165 U	101	106			
2,4,5-T	µg/kg	93765	0.131 U	84	85			
2,4,5-TB	µg/kg	93801	0.149 U	97	84			
2-Chlorotoluene	µg/kg	95498	1 U	104	101			
2,4,5-Trichlorophenol	µg/kg	95954	0.1 U	113	137			
2,4,6-Trichlorophenol	µg/kg	88062	0.1 U	97	74			
2-Hexanone	µg/kg	591786	1 U	97	97			
2,2-Dichloropropane	µg/kg	594207	1 U	92	88			
2-Butanone	µg/kg	78933	5 U	114	111			
2,4-DB	µg/kg	94826	0.199 U	83	102			
3,5-Dichlorobenzoic acid	µg/kg	51365	0.161 U	96	90			
3-OH-Carbofuran	µg/kg	16655826				18.1	97	107
4-Nitrophenol	µg/kg	100027	0.273 R	0	0			
4-Methyl-2-pentanone	µg/kg	108101	1 U	104	104			
4-Chlorotoluene	µg/kg	106434	1 U	107	105			
5-Hydroxydicamba	µg/kg	7600502	0.164 U	77	125			
Acetone	µg/kg	67641	5 U	129	116			
Acifluorfen	µg/kg	50594666	0.671 R	0	0			
Alachlor	µg/kg	15972608	0.3 U	81	79			
Aldrin	µg/kg	309002	0.03 U	24	17			
Alpha-BHC	µg/kg	319846	0.03 U	68	73			
Atrazine	µg/kg	19312249	0.1 U	91	90			
Azinphos-methyl	µg/kg	86500	0.1 U		NAR	NAR		

STATION NUMBER			4		4		4		5		5		5	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS)¹		Matrix Spike Duplicate (MSD)¹		Field Sample		Matrix Spike (MS)¹		Matrix Spike Duplicate (MSD)¹	
Azinphos-ethyl	µg/kg	2642719	0.1	U	85		92							
Bentazon	µg/kg	25057890	0.246	U	56		44							
Benzene	µg/kg	71432	0.07	J	102		97							
Benzoic acid, 3-amino-2,	µg/kg	133904	0.163	R	0		0							
Benzonitrile, 2,6-dichlo	µg/kg	1194656	0.2	U	77		73							
Beta-BHC	µg/kg	319857	0.03	U		NAR		NAR						
Bicyclo[2.2.1]hept-5-ene	µg/kg	115286	0.56	J										
Bromacil	µg/kg	314409	0.4	U	75		79							
Bromobenzene	µg/kg	108861	1	U	101		100							
Bromochloromethane	µg/kg	74975	1	U	112		111							
Bromodichloromethane	µg/kg	75274	1	U	99		97							
Bromoform	µg/kg	75252	2	U	92		99							
Bromomethane	µg/kg	74839	1	U	124		108							
Bromoxynil	µg/kg	1689845	0.165	U	60		45							
Carbaryl	µg/kg	63252							3.1	U	62		70	
Carbofuran	µg/kg	1563662							7.2		119		126	
Carbon Tetrachloride	µg/kg	56235	1	U	98		94							
Carbophenothion	µg/kg	786196	0.1	UJ	54		89							
Chlordane (Tech)	µg/kg	57749	0.36	U										
Chlorobenzene	µg/kg	108907	1	U	103		101							
Chloroethane	µg/kg	75003	1	U	146		133							
Chloroform	µg/kg	67663	1	U	102		99							
Chloromethane	µg/kg	74873	1	U	99		93							
Chlorpropham (CIPC)	µg/kg	101213	0.4	U		NAR		NAR						
Chlorpyrifos	µg/kg	2921882												
Chlorpyrifos-ethyl	µg/kg	5598130	0.1	U	77		83							
cis-1,2-Dichloroethene	µg/kg	156592	1	U	103		101							
Cis-1,3-Dichloropropene	µg/kg	10061015	1.1	U	97		95							
Coumaphos	µg/kg	56724	0.1	UJ		NAR		NAR						
Dalapon	µg/kg	75990	0.112	U	43		0							
DCPA (dacthal)	µg/kg	18611321	0.128	U	108		82							
Delta-BHC	µg/kg	319868	0.03	U		NAR		NAR						
Demeton-s	µg/kg	126750	0.1	UJ	767		775							
Demeton-O	µg/kg	298033	0.1	UJ	256		232							
Diazinon	µg/kg	333415	0.1	U		NAR		NAR						
Dibromochloromethane	µg/kg	124481	1	U	97		97							
Dibromomethane	µg/kg	74953	1	U	102		101							
Dicamba	µg/kg	1918009	0.163	U	126		119							
Dichlorodifluoromethane	µg/kg	75718	1	U	106		102							
Dichloroprop	µg/kg	120365	0.18	U	107		105							
DICLOFOP-METHYL	µg/kg	51338273	0.26	U	101		94							
Dieldrin	µg/kg	60571	0.05	U	73		73							
Dimethoate	µg/kg	60515	0.1	UJ		NAR		NAR						
Dinoseb	µg/kg	88857	0.246	R	0		0							
Diphenamid	µg/kg	957517	0.3	U	79		94							

STATION NUMBER			4	4	4	5	5	5
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Disulfoton	µg/kg	298044	0.1 UJ	271	227			
Endosulfan II	µg/kg	33213659	0.05 U	NAR	NAR			
Endosulfan Sulfate	µg/kg	1031078	0.05 U	75	81			
Endosulfan I	µg/kg	959988	0.03 U	72	76			
Endrin Ketone	µg/kg	53494705	0.05 U	77	97			
Endrin	µg/kg	72208	0.05 U	NAR	NAR			
Endrin Aldehyde	µg/kg	7421934	0.05 U	74	94			
EPN	µg/kg	2104645	0.1 U	81	96			
Ethalfuralin (Sonalan)	µg/kg	55283686	0.1 U	68	67			
Ethane, 1,1,2,2-tetrachl	µg/kg	79345	1 U	102	98			
Ethion	µg/kg	563122	0.1 U	72	97			
Ethoprop	µg/kg	13194484	0.1 U	NAR	NAR			
Ethylbenzene	µg/kg	100414	1 U	102	100			
Fenithrothion	µg/kg	122145	0.1 UJ	73	86			
Fensulfothion	µg/kg	115902	0.1 UJ	NAR	NAR			
Fenthion	µg/kg	55389	0.1 U	NAR	NAR			
Fluridone	µg/kg	59756604	1 UJ	151	89			
Fonophos	µg/kg	944229	0.1 U	85	78			
Heptachlor Epoxide	µg/kg	1024573	0.03 U	70	79			
Heptachlor	µg/kg	76448	0.03 U	44	33			
Hexachlorobutadiene	µg/kg	87683	1 U	98	94			
Imidan	µg/kg	732116	0.1 U	NAR	NAR			
Ioxynil	µg/kg	1689834	0.171 U	37	38			
Isopropylbenzene	µg/kg	98828	1 U	104	103			
Lindane	µg/kg	58899	0.03 U	NAR	NAR			
Malathion E50	µg/kg	121755	0.1 U	81	86			
MCPA	µg/kg	94746	0.325 U	113	120			
MCPP	µg/kg	93652	0.333 U	97	103			
Mercaptodimethur	µg/kg	2032657				21.9	52	70
Merphos	µg/kg	150505	0.1 U	58	72			
Metholachlor	µg/kg	51218452	0.4 U	88	82			
Methoxychlor	µg/kg	72435	0.05 U	53	83			
Methyl Chlorpyrifos	µg/kg		0.1 U	84	82			
Methylene Chloride	µg/kg	75092	1 U	204	179	J		
Metribuzin	µg/kg	21087649	0.1 U	85	54			
mp-Xylene	µg/kg		2 U	101	99			
n-Propylbenzene	µg/kg	103651	1 U	101	98			
n-Butylbenzene	µg/kg	104518	1 U	101	98			
Naphthalene	µg/kg	91203	1 U	77	78			
Napropamide	µg/kg	15299997	0.3 U	99	120			
Norflurazon	µg/kg	27314132	0.2 UJ	95	90			
o-Xylene	µg/kg	95476	1 U	101	99			
Oxyfluorfen	µg/kg	42874033	0.2 U	69	82			
p-Isopropyltoluene	µg/kg	99876	1 U	99	98			
P,P'-DDT	µg/kg	50293	0.05 U	0	NAR			

STATION NUMBER			4		4		4		5		5		5	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
P,P'-DDD	µg/kg	72548	0.05	U	60		81							
P,P'-DDE	µg/kg	72559	0.05	U	79		85							
Parathion-methyl	µg/kg	298000	0.1	U		NAR		NAR						
Parathion	µg/kg	56382	0.1	U		NAR		NAR						
Pendimethalin	µg/kg	40487421	0.1	U	77		70							
Pentachlorophenol	µg/kg	87865	0.02	J	102		109							
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	0.09	U	108		105							
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	0.09	U	107		113							
Phorate	µg/kg	298022	0.1	U		NAR		NAR						
Picloram	µg/kg	1918021	0.166	U	55		113							
Prometryne	µg/kg	7287196	0.1	U	81		98							
Pronamide (kerb)	µg/kg	23950585	0.4	U	77		81							
Propoxur	µg/kg	114261							3.1	U	137		151	
Ramrod	µg/kg	1918167	0.2	U	82		84							
Ronnel	µg/kg	299843	0.1	U		NAR		NAR						
sec-Butylbenzene	µg/kg	135988	1	U	103		99							
Silvex	µg/kg	93721	0.13	U	101		108							
Simazine	µg/kg	122349	0.1	UJ	103		101							
Styrene	µg/kg	100425	1	U	101		96							
Sulfotep	µg/kg	3689245	0.1	U	83		81							
Sulprofos	µg/kg	35400432	0.1	U		NAR		NAR						
Tebuthiuron	µg/kg	34014181	0.1	U	91		83							
Terbacil	µg/kg	5902512	0.3	U	62		59							
Tert-butylbenzene	µg/kg	98066	1	U	102		99							
Tetrachloroethene	µg/kg	127184	1	U	100		99							
Toluene	µg/kg	108883	1	U	104		102							
Total Xylenes	µg/kg	1330207	2	U	101		99							
Toxaphene	µg/kg	8001352	1.07	U		NAR	75							
trans-1,2-Dichloroethene	µg/kg	156605	1	U	103		98							
Trans-1,3-Dichloropropene	µg/kg	10061026	0.94	U	94		94							
Trichlopyr	µg/kg	55335063	0.132	U	97		86							
Trichloroethene	µg/kg	79016	1	U	101		98							
Trichlorofluoromethane	µg/kg	75694	1	U	123		121							
Trifluraline	µg/kg	1582098	0.1	U	66		66							
Vinyl Chloride	µg/kg	75014	1	U	108		103							

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-7. MS/MSD Organics Measurements of Samples 5 and 8.

STATION NUMBER			5		5		5		8		8		8	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			95080021-0		95080021-S1		95080021-S2		95240107-0		95240107-S1		95240107-S2	
1-Naphthol	ug/kg	90153	6.3	U	43.892		54.303							
2,4-D	ug/kg	94757							42	UJ	70.57		74.6	
2,4,5-T	ug/kg	93765							34	UJ	67.78		74.43	
2,4,5-TB	ug/kg	93801							38	UJ	74.71		79.47	
2,4,5-Trichlorophenol	ug/kg	95954							25	UJ	65.32		61.13	
2,4,6-Trichlorophenol	ug/kg	88062							25	UJ	61.69		65.59	
2,4-DB	ug/kg	94826							51	UJ	67.76		71.69	
3,5-Dichlorobenzoic acid	ug/kg	51365							42	UJ	64.82		67.72	
3-OH-Carbofuran	ug/kg	2e+07	18.1		96.592		106.61							
4-Nitrophenol	ug/kg	100027							230	UJ	111.96		178.98	
5-Hydroxydicamba	ug/kg	7600502							42	UJ	73.49		62.8	
Acifluorfen	ug/kg	50594666							170	UJ	39.53		38.18	
Alachlor	ug/kg	15972608							62	U	98.32		88.08	
Aldrin	ug/kg	309002							10	U	95.38		79.7	
Alpha-BHC	ug/kg	319846							10	U	104.11		90.15	
Atrazine	ug/kg	1912249							17	U	65.26		53.92	
Azinphos-methyl	ug/kg	86500							28	U	90.24		88.31	
Azinphos-ethyl	ug/kg	2642719							28	UJ				
Bentazon	ug/kg	25057890							63	UJ	73.84		86.95	
Benzoic acid, 3-amino-2,	ug/kg	133904							42	UJ	24.18		17	
Benzonitrile, 2,6-dichlo	ug/kg	1194656							1.5	NJ	81.63		67.07	
Beta-BHC	ug/kg	319857							10	U	128.19		118.11	
Bromacil	ug/kg	314409							70	U	77.49		70.19	
Bromoxynil	ug/kg	1689845							42	UJ	51.26		60.7	
Carbaryl	ug/kg	63252	3.1	U	61.94		70.256							
Carbofuran	ug/kg	2e+06	7.2		119.12		125.63							
Carbophenothion	ug/kg	786196							17	U				
Chlordane (Tech)	ug/kg	57749							70	U				
Chlorpropham (CIPC)	ug/kg	101213							70	U				
Chlorpyrifos	ug/kg	2921882							12	U				
Chlorpyrifos-ethyl	ug/kg	5598130							12	U				
Coumaphos	ug/kg	56724							21	UJ	110.16		111.64	
Dalapon	ug/kg	75990							850	UJ	79.14		95.03	
DCPA	ug/kg	1861321							34	UJ	70.36		71.49	
Delta-BHC	ug/kg	319868							10	U	117.85		106.35	
Demeton-s	ug/kg	126750							12	U				
Demeton-0	ug/kg	298033							12	U				
Diazinon	ug/kg	333415							14	U	153.71		137.85	
Dicamba	ug/kg	1918009							34	UJ	71.59		73.45	
Dichlorprop	ug/kg	120365							46	UJ	76.81		82.25	
Diclofop-methyl	ug/kg	51338273							63	UJ	61.48		70.02	
Dieldrin	ug/kg	60571							10	U	104.28		93.47	
Dimethoate	ug/kg	60515							14	U	64.56		42.72	

STATION NUMBER			5	5	5	8	8	8
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Dinoseb	ug/kg	88857				150 UJ	56.94	53.18
Diphenamid	ug/kg	957517				52 U	88.48	68.15
Disulfoton	ug/kg	298044				10 U		
Endosulfan II	ug/kg	33213659				10 U	113.55	101.59
Endosulfan Sulfate	ug/kg	1031078				10 U	101.19	93.26
Endosulfan I	ug/kg	959988				10 U	115.66	101.75
Endrin Ketone	ug/kg	53494705				10 U	54.04	56.57
Endrin	ug/kg	72208				10 U	112.18	99.57
Endrin Aldehyde	ug/kg	7421934				10 U	70.49	57.01
EPN	ug/kg	2104645				17 U		
Ethalfuralin (Sonalan)	ug/kg	55283686				26 U	91.79	90.49
Ethion	ug/kg	563122				12 U		
Ethoprop	ug/kg	13194484				14 U	123.17	109.2
Fenithrothion	ug/kg	122145				12 U		
Fensulfothion	ug/kg	115902				17 UJ	137.56	127.14
Fenthion	ug/kg	55389				12 U	126.97	99.76
Fluridone	ug/kg	59756604				100 UJ	81.29	65.16
Fonophos	ug/kg	944229				10 U		
Heptachlor Epoxide	ug/kg	1024573				10 U	113.31	105.31
Heptachlor	ug/kg	76448				10 U	50.17	48.36
Imidan	ug/kg	732116				19 UJ	116.49	110.87
Ioxynil	ug/kg	1689834				42 UJ	39.69	48.99
Lindane	ug/kg	58899				10 U	96.48	90.14
Malathion E50	ug/kg	121755				14 U		
MCPA	ug/kg	94746				85 UJ	83.48	88.05
MCPP	ug/kg	93652				85 UJ	88.8	91.46
Mercaptodimethur	ug/kg	2e+06	21.9	52.267	70.103			
Merphos	ug/kg	150505				28 UJ		
Metholachlor	ug/kg	51218452				70 U	78.98	76.39
Methoxychlor	ug/kg	72435				10 UJ	26.01	26.18
Metribuzin	ug/kg	21087649				17 U	71.29	55.66
Napropamide	ug/kg	15299997				52 U	111.59	95.75
Norflurazon	ug/kg	27314132				35 U	99.15	90.38
Oxyfluorfen	ug/kg	42874033				70 U		
P,P'-DDT	ug/kg	50293				10 UJ	24.41	25.5
P,P'-DDD	ug/kg	72548				3 NJ	150.39	132.92
P,P'-DDE	ug/kg	72559				10 U	129.29	111.62
Parathion-methyl	ug/kg	298000				12 U	111.78	108.53
Parathion	ug/kg	56382				14 U	145.94	137.85
Pendimethalin	ug/kg	40487421				26 U	72.77	61.78
Pentachlorophenol	ug/kg	87865				20 UJ	73.21	82.55
Phenol, 2,3,4,6-tetrachl	ug/kg	58902				23 UJ	66.21	73.83
Phenol, 2,3,4,5-tetrachl	ug/kg	4901513				23 UJ	67.47	75.17
Phorate	ug/kg	298022				12 U	133.28	99.5
Picloram	ug/kg	1918021				42 UJ	56.04	55.36

STATION NUMBER			5	5	5	8	8	8
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Prometryne	ug/kg	7287196				17	UJ	53.23
Pronamide (kerb)	ug/kg	23950585				70	UJ	4.69
Propoxur	ug/kg	114261	3.1	U	136.59	151.25		
Ramrod	ug/kg	1918167				42	U	100.12
Ronnel	ug/kg	299843				12	U	111.56
Silvex	ug/kg	93721				34	UJ	90.31
Simazine	ug/kg	122349				17	UJ	119.16
Sulfotep	ug/kg	3689245				10	U	
Sulprofos	ug/kg	35400432				12	U	131.5
Tebuthiuron	ug/kg	34014181				26	U	79.48
Terbacil	ug/kg	5902512				52	U	104.63
Toxaphene	ug/kg	8001352				350	U	
Trichlopyr	ug/kg	55335063				34	UJ	70.41
Trifluraline	ug/kg	1582098				26	U	81.02

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-8. MS/MSD Organics Measurements of Sample 7.

STATION NUMBER			7		7		7		7		7			
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS)¹		Matrix Spike Duplicate (MSD)¹		Field Sample		Matrix Spike (MS)¹		Matrix Spike Duplicate (MSD)¹	
Sample Number			95240104-0		95240104-S1		95240104-S2		95240103-0		95240103-S1		95240103-S2	
2,4-D	µg/kg	94757	0.12		42.93		109.71							
2,4,5-T	µg/kg	93765	0.1	U	47.36		128.88							
2,4,5-TB	µg/kg	93801	0.12	U	57.11		117.76							
2,4,5-Trichlorophenol	µg/kg	95954	0.08	U	82.21		84.94							
2,4,6-Trichlorophenol	µg/kg	88062	0.08	U	54.18		81.89							
2,4-DB	µg/kg	94826	0.16	U	52.09		104.55							
3,5-Dichlorobenzoic acid	µg/kg	51365	0.13	U	47.5		62.71							
4-Nitrophenol	µg/kg	100027			8.63		10.88							
5-Hydroxydicamba	µg/kg	7600502	0	R	0.94		1.52							
Acifluorfen (Blazer)	µg/kg	62476599	0.53	U	32.02		22.72							
Alachlor	µg/kg	15972608							0.29	U	85.48		85.79	
Aldrin	µg/kg	309002							0.048	UJ	9		10	
Alpha-BHC	µg/kg	319846							0.048	U	86.09		87.6	
Atrazine	µg/kg	1912249							0.08	U	96.76		76.13	
Azinphos-methyl	µg/kg	86500							0.21					
Azinphos-ethyl	µg/kg	2642719							0.13	U				
Bentazon	µg/kg	25057890	0.2	UJ	16.19		27.27							
Benzoic acid, 3-amino-2,	µg/kg	133904	0.13	UJ	18		3.3							
Benzonitrile, 2,6-dichlo	µg/kg	1194656							1.9		109		76	
Beta-BHC	µg/kg	319857							0.048	U	123.32		127	
Bromacil	µg/kg	314409							0.32	U	72.31		79.41	
Bromoxynil	µg/kg	1689845	0.13	U	46.73		39.99							
Carbophenothion	µg/kg	786196							0.08	U	107.57		105.1	
Chlordane (Tech)	µg/kg	57749							0.32	U				
Chlorpropham (CIPC)	µg/kg	101213							0.1	J				
Chlorpyrifos	µg/kg	2921882							0.044	J	117.96		74.92	
Chlorpyrifos-ethyl	µg/kg	5598130							0.056	U				
Coumaphos	µg/kg	56724							0.096	UJ				
Dalapon	µg/kg	75990	0	REJ	0.41		2.15							
DCPA	µg/kg	1861321	0.1	UJ	5.69		4.21							
Delta-BHC	µg/kg	319868							0.048	U	98.27		99.16	
Demeton-s	µg/kg	126750							0.056	UJ	79		80	
Demeton-0	µg/kg	298033							0.056	U	34.53		33.58	
Diazinon	µg/kg	333415							0.23					
Dicamba	µg/kg	1918009	0.13	UJ	4.18		43.64							
Dichlorprop	µg/kg	120365	0.14	U	62.1		112.64							
Diclofop-methyl	µg/kg	51338273	0.2	U	76.85		120.55							
Dieldrin	µg/kg	60571							0.048	U	74.48		78.76	
Dimethoate	µg/kg	60515							0.064	U				
Dinoseb	µg/kg	88857	0.2	U	33.77		29.14							
Diphenamid	µg/kg	957517							0.24	U	89.94		83.83	
Disulfoton	µg/kg	298044							0.28	U				
Endosulfan II	µg/kg	33213659							0.048	U	94.89		96.75	

STATION NUMBER			7	7	7	7	7	7
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'
Endosulfan Sulfate	µg/kg	1031078				0.048 U	87.54	91.47
Endosulfan I	µg/kg	959988				0.048 U	87.49	86.81
Endrin Ketone	µg/kg	53494705				0.048 U	89.05	91.89
Endrin	µg/kg	72208				0.048 U	90.27	91
Endrin Aldehyde	µg/kg	7421934				0.048 U	63.73	64.4
EPN	µg/kg	2104645				0.08 U	105.25	105.5
Ethalfuralin (Sonalan)	µg/kg	55283686				0.07 U	84.85	84.51
Ethion	µg/kg	563122				0.056 U	88.96	87.05
Ethoprop	µg/kg	13194484				0.064 U		
Fenithrothion	µg/kg	122145				0.056 U	110.62	111.7
Fensulfothion	µg/kg	115902				0.08 UJ		
Fenthion	µg/kg	55389				0.034 U		
Fluridone	µg/kg	59756604				0.48 UJ	39.28	42.55
Fonophos	µg/kg	944229				0.048 U		
Heptachlor Epoxide	µg/kg	1024573				0.048 U	84.15	86.41
Heptachlor	µg/kg	76448				0.048 UJ	17	17
Imidan	µg/kg	732116				0.088 UJ		
Indeno(1,2,3-cd)pyrene	µg/kg	193395						
Ioxynil	µg/kg	1689834	0.13 U	42.34	39.7			
Lindane	µg/kg	58899				0.048 U	100.01	101.8
Malathion E50	µg/kg	121755				0.064 U	133.47	133.3
MCPA	µg/kg	94746	0.26 U	47.18	106.62			
MCPP	µg/kg	93652	0.26 U	60.82	101.8			
Merphos	µg/kg	150505				0.13 UJ	73.56	120.4
Metholachlor	µg/kg	51218452				0.32 U	73.65	72.29
Methoxychlor	µg/kg	72435				0.048 U	89.21	92.19
Methyl Chlorpyrifos	µg/kg						114.13	115.4
Metribuzin	µg/kg	21087649				0.08 U	86.07	84.41
Napropamide	µg/kg	15299997				0.2	101	98
Norflurazon	µg/kg	27314132				1	64	62
Oxyfluorfen	µg/kg	42874033				0.32 U		
P,P'-DDT	µg/kg	50293				0.12 U	90.74	91.79
P,P'-DDD	µg/kg	72548				0.009 J	89.52	92.14
P,P'-DDE	µg/kg	72559				0.048 U	69.58	69.2
Parathion-methyl	µg/kg	298000				0.056 U		
Parathion	µg/kg	56382				0.031 U		
Pendimethalin	µg/kg	40487421				0.12 U	67.894	60.87
Pentachlorophenol	µg/kg	87865	0 U	81.96	103.61			
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	0.07 U	35.47	98.13			
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	0.07 U	91.5	111.51			
Phorate	µg/kg	298022				0.056 U		
Picloram	µg/kg	1918021	0 R	0.55	8.47			
Prometryne	µg/kg	7287196				0.08 U	33	26
Pronamide (kerb)	µg/kg	23950585				0.32 U	93.94	86.95
Ramrod	µg/kg	1918167				0.19 U	90.29	87.67

STATION NUMBER			7	7	7	7	7	7
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Ronnel	µg/kg	299843				0.056	U	
Silvex	µg/kg	93721	0.1	U	66.59	115.33		
Simazine	µg/kg	122349				0.022	UJ	142.95
Sulfotep	µg/kg	3689245				0.048	U	136.01
Sulprofos	µg/kg	35400432				0.056	U	
Tebuthiuron	µg/kg	34014181				0.12	U	64.39
Terbacil	µg/kg	5902512				0.24	U	78.83
Toxaphene	µg/kg	8001352				1.6	U	
Trichlopyr	µg/kg	55335063	0.03	J	55.27	111.74		
Trifluraline	µg/kg	1582098				0.12	U	63.47

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-9. MS/MSD Metals Measurements of Samples 2 and 14

STATION NUMBER			14		14		14		2		2
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹
Sample Number			94334300-0		94334300-S1		94334300-S2		95080026-0		95080026-S1
Aluminum	mg/kg	7429905	5620			NA		NA			
Antimony	mg/kg	7440360	4	U	85		86				
Barium	mg/kg	7440393	6.08		102		103				
Beryllium	mg/kg	7440417	0.19	P	107		108				
Cadmium	mg/kg	7440439	0.2	U	91		87				
Calcium	mg/kg	7440702	1600			NA		NA			
Chromium	mg/kg	7440473	11.1		97		98		2	U	95
Copper	mg/kg	7440508	3.84		101		102				
Iron	mg/kg	7439896	12900			NA		NA			
Magnesium	mg/kg	7439954	3170			NA		NA			
Manganese	mg/kg	7439965	141		85		102				
Mercury	mg/kg	7439976	0.05	U	102		100				
Nickel	mg/kg	7440020	8.87		105		105				
Potassium	mg/kg	7440097	730			NA		NA			
Sodium	mg/kg	7440235	2910			NA		NA			

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-10. MS/MSD Metals Measurements of Samples 4 and 23

STATION NUMBER			23		23		23		4		4		4	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			95080020-0		95080020-S1		95080020-S2		95080024-0		95080024-S1		95080024-S2	
Aluminum	mg/kg	7429905	15100			NA		NA	335	N	58		83	
Antimony	mg/kg	7440360	4	UN	11		0		0.5	U	100		100	
Barium	mg/kg	7440393	23.3		97		96		17.1	B	99		98	
Beryllium	mg/kg	7440417	0.808		96		96		0.3	U	107		107	
Cadmium	mg/kg	7440439	0.2	U	91		92		0.3	U	96		97	
Calcium	mg/kg	7440702	3850			NA		NA	8030			NA		NA
Chromium	mg/kg	7440473	30.4		89		93		1	U	108		108	
Copper	mg/kg	7440508	28.4		94		94		1.6	P	101		101	
Iron	mg/kg	7439896	36100			NA		NA	569			NA		NA
Magnesium	mg/kg	7439954	7380			NA		NA	3200			NA		NA
Manganese	mg/kg	7439965	145		87		92		27.4		105		106	
Mercury	mg/kg	7439976	0.04		82		80		0.1	U	96		98	
Nickel	mg/kg	7440020	19.6		91		91		1.61		102		102	
Potassium	mg/kg	7440097	2680			NA		NA	1400	P		NA		NA
Silver	mg/kg	7440224							0.1	UN	45		47	
Sodium	mg/kg	7440235	13300			NA		NA	16800			NA		NA
Zinc	mg/kg	7440666							59.5		93		91	

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-11. MS/MSD Metals Measurements of Samples 6 and 7

STATION NUMBER			6		6		6		7		7		7	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			95240100-0		95240100-S1		95240100-S2		95240102-0		95240102-S1		95240102-S2	
Aluminum	mg/kg	7429905	6050			NA		NA						
Antimony	mg/kg	7440360	8	U	85		87							
Barium	mg/kg	7440393	14.4		94		100							
Beryllium	mg/kg	7440417	0.229		102		108							
Cadmium	mg/kg	7440439	0.08	U	96		103							
Calcium	mg/kg	7440702	1660			NA		NA						
Chromium	mg/kg	7440473	11.2		92		101							
Cobalt	mg/kg	7440484	3.94		91		96							
Copper	mg/kg	7440508	5.25		92		101							
Iron	mg/kg	7439896	20300			NA		NA						
Magnesium	mg/kg	7439954	3090			NA		NA						
Manganese	mg/kg	7439965	130		92		110							
Mercury	mg/kg	7439976							0.1	U	93		90	
Nickel	mg/kg	7440020	8.57		92		98							
Potassium	mg/kg	7440097	358			NA		NA						
Silver	mg/kg	7440224	0.44	P	89		95							
Sodium	mg/kg	7440235	132			NA		NA						
Vanadium	mg/kg	7440622	27.4		90		99							
Zinc	mg/kg	7440666	35.3		86		94							

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-12. MS/MSD Metals Measurements of Samples 8 and 9

STATION NUMBER			8	8	8	9	9
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹
Sample Number			95240106-0	95240106-S1	95240106-S2	95240108-0	95240108-S1
Aluminum	mg/kg	7429905				71 P	108
Antimony	mg/kg	7440360				0.5 U	109
Barium	mg/kg	7440393				2.5 P	100
Beryllium	mg/kg	7440417				0.3 U	97
Cadmium	mg/kg	7440439				0.3 U	93
Calcium	mg/kg	7440702				12900	NA
Chromium	mg/kg	7440473				1 U	92
Cobalt	mg/kg	7440484				10 U	102
Copper	mg/kg	7440508				3 U	104
Iron	mg/kg	7439896				4840	NA
Magnesium	mg/kg	7439954				22900	NA
Manganese	mg/kg	7439965				110	98
Mercury	mg/kg	7439976	0.02 U	103	102		
Nickel	mg/kg	7440020				0.3 U	82
Potassium	mg/kg	7440097				8340	NA
Silver	mg/kg	7440224				0.1 UNE	29
Sodium	mg/kg	7440235				167000	NA
Vanadium	mg/kg	7440622				3 U	107
Zinc	mg/kg	7440666				11 PB	99

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-13. MS/MSD General Chemistry Measurements of Samples 2, 4, 7, and 9.

STATION NUMBER		2	2	2	4	4	4
Target Compound	Units	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Sample Number		95080026-0	95080026-S1	95080026-S2	95080024-0	95080024-S1	95080024-S2
Alkalinity	mg/l				18.8	98.4	98.5
Chloride	mg/l	41.9	104	104			
Fluoride	mg/l	0.067	93	94			
Nh3+Nh4	mg/l	0.052 J	98	97			
Nitrate+Nitrite	mg/l	1.22	101	100			
Total K	mg/l				0.025 U	79.8	85
Sulfate	mg/l	51.4	99	106			
Station Number		7	7	7	9	9	9
Sample Number		95240105-0	95240105-S1	95240105-S2	95240111-0	95240111-S1	95240111-S2
Alkalinity	mg/l	53.4	102	102			
Chloride	mg/l				269	103	103
Fluoride	mg/l				0.106	95.5	95.8
Kjel-n	mg/l				0.371 J	71.4	92.5
Nh3+Nh4	mg/l				0.074	118	118
Nitrate+Nitrite	mg/l	0.174	90.5	91			
Total K	mg/l				0.245	121	125
Sulfate	mg/l				40.1	94.5	94.5

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-14. MS/MSD Organics Measurements of Samples 10 and 11.

STATION NUMBER			10		10		10		11		11		11	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			94334301-0		94334301-S1		94334301-S2		94334302-0		94334302-S1		94334302-S2	
1,4-Dichlorobenzene	µg/kg	106467	3.5	U	72.56		69.84		108	U	65.36		29.38	
1,2-Diphenylhydrazine	µg/kg	122667							108	U				
1,2,3-Trichloropropane	µg/kg	96184	3.5	U	89.58		87.39							
1,2-Dibromo-3-chloropropane	µg/kg	96128	3.5	U	76.67		84.84							
1,2,4-Trimethylbenzene	µg/kg	95636	3.5	U	83.72		77.92							
1,2-Dichlorobenzene	µg/kg	95501	3.5	U	79.59		77.03		108	U	68.14		31.89	
1,2,3-Trichlorobenzene	µg/kg	87616	3.5	UJ	47.07		53.52							
1,1,2-Trichloroethane	µg/kg	79005	3.5	U	97.11		88.93							
1,2-Dichloropropane	µg/kg	78875	3.5	U	95.91		87.95							
1,1-dichloroethene	µg/kg	75354	3.5	U	100.44		75.59							
1,1-Dichloroethane	µg/kg	75343	3.5	U	97.33		92.5							
1,1,1-Trichloroethane	µg/kg	71556	3.5	U	92.8		85.24							
1,1,1,2-Tetrachloroethane	µg/kg	630206	3.5	U	65.93		68.94							
1,1-Dichloropropene	µg/kg	563586	3.5	U	88.65		83.45							
1,3-Dichlorobenzene	µg/kg	541731	3.5	U	74.01		70.92		108	U	62.79		27.5	
1,3-Dichloropropane	µg/kg	142289	3.5	U	86.66		81.95							
1,2,4-Trichlorobenzene	µg/kg	120821	3.5	UJ	46.08		49.07		108	UJ	71.51		36.81	
1,3,5-Trimethylbenzene	µg/kg	108678	3.5	U	84.58		80.01							
1,2-Dichloroethane	µg/kg	107062	3.5	U	91.82		83.5							
1,2-Dibromoethane	µg/kg	106934	3.5	U	70.17		71.31							
1H-Indole, dibromo	µg/kg		35	J										
2-Chlorotoluene	µg/kg	95498	3.5	U	86.05		80.56							
2,4,5-Trichlorophenol	µg/kg	95954							108	U	93.95		82.51	
2-Chlorophenol	µg/kg	95578							108	U	81.17		50.85	
2-Methylphenol	µg/kg	95487							108	U	89.04		64.21	
2-Chloronaphthalene	µg/kg	91587							108	U	83.55		60.69	
2-Nitrophenol	µg/kg	88755							108	UJ	82.59		44.85	
2-Nitroaniline	µg/kg	88744							108	U	107.52		88.43	
2,4,6-Trichlorophenol	µg/kg	88062							108	U	86.22		72.18	
2-Hexanone	µg/kg	591786	3.4	J	36		34							
2,6-Dinitrotoluene	µg/kg	606202							108	U	85.44		72.25	
2,2-Dichloropropane	µg/kg	594207	3.5	U	92.12		82.29							
2-Butanone	µg/kg	78933	15.1	U		NAR		NAR						
2,4-Dinitrophenol	µg/kg	51285							1080	UJ	69.56	J	53.18	J
2,4-Dinitrotoluene	µg/kg	121142							108	U	87.7		71.14	
2,4-Dichlorophenol	µg/kg	120832							108	U	80.3		60.1	
2,4-Dimethylphenol	µg/kg	105679							108	U	78.46		66.33	
3-Nitroaniline	µg/kg	99092							108	UJ	36.47		21.88	
4-Nitrophenol	µg/kg	100027							541	UJ	99.74	J	81.19	J
4-Bromophenyl-Phenylether	µg/kg	101553							108	U	89.05		73.89	
4-Methylphenol	µg/kg	106445							108	U	89.89		64.83	
4,6-Dinitro-2-methylphenol	µg/kg	534521							1080	U	89.87		68.34	
4-Nitroaniline	µg/kg	100016							108	UJ	59.74		41.26	

STATION NUMBER			10		10		10		11		11		11	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹		Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
4-Chloro-3-methylphenol	µg/kg	59507							108	U	96.58		77.26	
4-Chlorophenyl-Phenylether	µg/kg	7005723							108	U	89.33		72.14	
4-Methyl-2-pentanone	µg/kg	108101	0.95	J	73		75							
4-Chlorotoluene	µg/kg	106434	3.5	U	76.75		73.61							
9H-Fluorene	µg/kg	86737							108	U	88.91		71.4	
Acenaphthene	µg/kg	83329							108	U	88.25		68.12	
Acenaphthylene	µg/kg	208968							108	U	89.23		67.96	
Acetone	µg/kg	67641	51.3	U		NAR		NAR						
Alachlor	µg/kg	15972608	78	U										
Aldrin	µg/kg	309002	9.75	U	74		69							
Alpha-BHC	µg/kg	319846	9.75	U	75		65							
Aniline	µg/kg	62533							108	U				
Anthracene	µg/kg	120127							108	U	74.4		61.29	
Atrazine	µg/kg	1912249	32.5	U										
Azinphos-methyl	µg/kg	86500	52	U										
Azinphos-ethyl	µg/kg	2642719	52	U										
Benzene	µg/kg	71432	3.5	U	100.82		92.2							
Benzo [b] fluoranthene	µg/kg	205992							108	U	92.3		76.78	
Benzo(a)anthracene	µg/kg	56553							108	U	92.18		76.52	
Benzo(a)pyrene	µg/kg	50328							108	U	86.14		71.99	
Benzo(g,h,i)perylene	µg/kg	191242							108	U	90.66		75.27	
Benzoic acid	µg/kg	65850							1080	UJ	51.25		49.07	
Benzonitrile, 2,6-dichlo	µg/kg	1194656	39	U										
Benzo[k]fluoranthene	µg/kg	207089							108	U	90.04		74.41	
Benzyl alcohol	µg/kg	100516							108	U	90.49		57.01	
Beta-BHC	µg/kg	319857	9.75	U	87		81							
bis(2-Chloroisopropyl)ether	µg/kg	39638329							108	UJ	90.29		49.52	
bis(2-Chloroethoxy)methane	µg/kg	111911							108	U	90.32		56.76	
bis(2-Chloroethyl)ether	µg/kg	111444							108	UJ	85.52		43.53	
Bis(2-ethylhexyl) phthal	µg/kg	117817							108	U	95		80	
Bromacil	µg/kg	314409	195	U										
Bromobenzene	µg/kg	108861	3.5	U	84.45		81.74							
Bromochloromethane	µg/kg	74975	3.5	U	114.35		98.16							
Bromodichloromethane	µg/kg	75274	3.5	U	50.24		60.24							
Bromoform	µg/kg	75252	3.5	UJ	32.69		48.78							
Bromomethane	µg/kg	74839	3.5	U	81.61		75.12							
Butylbenzylphthalate	µg/kg	85687							108	U	92.17		78	
Carbon Tetrachloride	µg/kg	56235	3.5	U	67.11		71.67							
Carbophenothion	µg/kg	786196	32.5	U										
Chlordane (Tech)	µg/kg	57749	130	U										
Chlorobenzene	µg/kg	108907	3.5	U	84.37		80.54							
Chloroethane	µg/kg	75003	3.5	U	102.03		91.37							
Chloroform	µg/kg	67663	3.5	U	99		85							
Chloromethane	µg/kg	74873	3.5	U	89.92		85.33							
Chlorpropham (CIPC)	µg/kg	101213	163	U										

STATION NUMBER			10	10	10	11	11	11
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Chlorpyrifos-ethyl	µg/kg	5598130	22.8	U				
Chrysene	µg/kg	218019				108	U	94.73
cis-1,2-Dichloroethene	µg/kg	156592	3.5	U	92.27			87.08
Cis-1,3-Dichloropropene	µg/kg	10061015	3.7	UJ	49.38			58.93
Coumaphos	µg/kg	56724	39	U				
Delta-BHC	µg/kg	319868	9.75	U	85			83
Demeton-s	µg/kg	126750	22.8	U				
Demeton-O	µg/kg	298033	22.8	U				
Di-n-Butylphthalate	µg/kg	84742				108	U	97
Di-n-octylphthalate	µg/kg	117840				108	U	96.79
Diazinon	µg/kg	333415	26	U				239.72
Dibenzofuran	µg/kg	132649				108	U	81.26
Dibenz[a,h]anthracene	µg/kg	53703				108	U	87.63
Dibromochloromethane	µg/kg	124481	3.5	UJ	38.87			71.19
Dibromomethane	µg/kg	74953	3.5	U	111.76			77.5
Dichlorodifluoromethane	µg/kg	75718	3.5	U	62.49			
Dieldrin	µg/kg	60571	19.5	U	80			57.25
Diethyl phthalate	µg/kg	84662				108	U	82
Dimethoate	µg/kg	60515	26	U				
Dimethylphthalate	µg/kg	131113				108	U	97.15
Diphenamid	µg/kg	957517	97.5	U				80.73
Disulfoton	µg/kg	298044	19.5	U				
Endosulfan II	µg/kg	33213659	19.5	U	86			
Endosulfan Sulfate	µg/kg	1031078	19.5	U	79			83
Endosulfan I	µg/kg	959988	9.75	U	92			78
Endrin Ketone	µg/kg	53494705	19.5	U	76			83
Endrin	µg/kg	72208	19.5	U	90			73
Endrin Aldehyde	µg/kg	7421934	19.5	U	68			87
EPN	µg/kg	2104645	32.5	U				62
Ethalfuralin (Sonalan)	µg/kg	55283686	48.8	U				
Ethane, 1,1,2,2-tetrachl	µg/kg	79345	3.5	U	110.13			107.45
Ethion	µg/kg	563122	22.8	U				
Ethoprop	µg/kg	13194484	26	U				
Ethylbenzene	µg/kg	100414	3.5	U	84.42			78.63
Fenithrothion	µg/kg	122145	22.8	U				
Fensulfothion	µg/kg	115902	32.5	U				
Fenthion	µg/kg	55389	22.8	U				
Fluoranthene	µg/kg	206440				108	U	95.91
Fluridone	µg/kg	59756604	260	U				76.65
Fonophos	µg/kg	944229	19.5	U				
Heptachlor Epoxide	µg/kg	1024573	9.75	U	86			81
Heptachlor	µg/kg	76448	9.75	U	80			67
Hexachlorobenzene	µg/kg	118741				108	U	92.29
Hexachlorobutadiene	µg/kg	87683	3.5	U	71.09			75.13
Hexachloroethane	µg/kg	67721				108	UJ	75.9
								39.61
								31

STATION NUMBER			10	10	10	11	11	11
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Imidan	µg/kg	732116	35.8	U				
Indeno(1,2,3-cd)pyrene	µg/kg	193395				108	U	93.2
Isophorone	µg/kg	78591				108	U	90.73
Isopropylbenzene	µg/kg	98828	3.5	U	91.9			87.27
Lindane	µg/kg	58899	9.75	U	81			71
Malathion E50	µg/kg	121755	26	U				
Merphos	µg/kg	150505	52	U				
Metholachlor	µg/kg	51218452	97.5	U				
Methoxychlor	µg/kg	72435	19.5	U	78			86
Methylene Chloride	µg/kg	75092	3.5	U	120.99			108.83
Metribuzin	µg/kg	21087649	32.5	U				
MP-Xylene	µg/kg		7	U	160.53			152.09
n-Propylbenzene	µg/kg	103651	3.5	U	83.17			78.55
n-Butylbenzene	µg/kg	104518	3.5	U	69.23			64.65
n-Nitrosodimethylamine	µg/kg	62759				108	U	
n-Nitrosodiphenylamine	µg/kg	86306				108	U	
N-Nitrosodipropylamine	µg/kg	621647				108	U	93.34
Naphthalene, 2-methyl-	µg/kg	91576				108	U	81.08
Naphthalene	µg/kg	91203	17.5	U	65.28			78.53
Napropamide	µg/kg	15299997	97.5	U				
Nitrobenzene	µg/kg	98953				108	U	90.21
Norflurazon	µg/kg	27314132	48.8	U				
o-Xylene	µg/kg	95476	3.5	U	85.09			80.86
Oxyfluorfen	µg/kg	42874033	84.5	U				
p-Isopropyltoluene	µg/kg	99876	3.5	U	80.11			76.56
P,P'-DDT	µg/kg	50293	19.5	U	72			82
P,P'-DDD	µg/kg	72548	19.5	U	90			88
P,P'-DDE	µg/kg	72559	19.5	U	86			82
Parathion-methyl	µg/kg	298000	22.8	U				
Parathion	µg/kg	56382	26	U				
Pendimethalin	µg/kg	40487421	48.8	U				
Pentachlorophenol	µg/kg	87865				108	U	77.13
Phenanthrene	µg/kg	85018				108	U	89.51
Phenol	µg/kg	108952				108	U	89.43
Phorate	µg/kg	298022	22.8	U				
Prometryne	µg/kg	7287196	32.5	U				
Pronamide (kerb)	µg/kg	23950585	97.5	U				
Pyrene	µg/kg	129000				108	U	88.1
Ramrod	µg/kg	1918167	65	U				
Ronnel	µg/kg	299843	22.8	U				
sec-Butylbenzene	µg/kg	135988	3.5	U	87.87			82.9
Simazine	µg/kg	122349	32.5	U				
Styrene	µg/kg	100425	3.5	U	69.97			68.98
Sulfotep	µg/kg	3689245	19.5	U				
Sulprofos	µg/kg	35400432	22.8	U				

STATION NUMBER			10	10	10	11	11	11
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Tebuthiuron	µg/kg	34014181	32.5 U					
Terbacil	µg/kg	5902512	163 U					
Tert-butylbenzene	µg/kg	98066	3.5 U	93.58	88.82			
Tetrachloroethene	µg/kg	127184	3.5 U	76.53	72.41			
Toluene	µg/kg	108883	3.5 U	90.21	83.68			
Total Xylenes	µg/kg	1330207	10.5 U	0	0			
trans-1,2-Dichloroethene	µg/kg	156605	3.5 U	91.67	85.52			
Trans-1,3-Dichloropropene	µg/kg	10061026	3.3 UJ	38.92	50.56			
Trichloroethene	µg/kg	79016	3.5 U	74.26	69.99			
Trichlorofluoromethane	µg/kg	75694	3.5 U	76.81	68.94			
Trifluraline	µg/kg	1582098	48.8 U					
Vinyl Chloride	µg/kg	75014	3.5 U	93.73	85.91			

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-15. MS/MSD Organics Measurements of Samples 12A and 13.

STATION NUMBER			12A	12A	12A	13	13	13
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Sample Number			95080022-0	95080022-S1	95080022-S2	94334304-0	94334304-S1	94334304-S2
2,4-D	µg/kg	94757				61 U	101	87
2,4,5-T	µg/kg	93765				48 U	95	88
2,4,5-TB	µg/kg	93801				55 U	104	84
2,4,5-Trichlorophenol	µg/kg	95954				35 U	60	54
2,4,6-Trichlorophenol	µg/kg	88062				36 U	66	53
2,4-DB	µg/kg	94826				73 U	102	83
3,5-Dichlorobenzoic acid	µg/kg	51365				59 U	87	68
4-Nitrophenol	µg/kg	100027				104 U	78	51
5-Hydroxydicamba	µg/kg	7600502				60 U	55	50
Acifluorfen	µg/kg	50594666				248 U	33	25
Bentazon	µg/kg	25057890				91 U	83	66
Benzoic acid, 3-amino-2,	µg/kg	133904				60 U	17	14
Bromoxynil	µg/kg	1689845				10 J	42	34
Butyltin trichloride	µg/kg	1118463	10.7 U	1380 J	1280 J			
Dalapon	µg/kg	75990				165 U	32	32
DCPA (dacthal)	µg/kg	18611321						
DCPA	µg/kg	1861321				47 U	105	77
Delta-BHC	µg/kg	319868						
Demeton-s	µg/kg	126750						
Demeton-0	µg/kg	298033						
Di-n-Butylphthalate	µg/kg	84742						
Di-n-octylphthalate	µg/kg	117840						
Diazinon	µg/kg	333415						
Dibenzofuran	µg/kg	132649						
Dibenz[a,h]anthracene	µg/kg	53703						
Dibromochloromethane	µg/kg	124481						
Dibromomethane	µg/kg	74953						
Dibutyltin dichloride	µg/kg	683181	10.8 U	237 J	169 J			
Dicamba	µg/kg	1918009				60 U	93	77
Dichlorobenzoic Acid	µg/kg					59 R	0	0
Dichloroprop	µg/kg	120365				67 U	99	81
Diclofop-methyl	µg/kg	51338273				96 U	93	83
Dinoseb	µg/kg	88857				91 R	0	0
Ioxynil	µg/kg	1689834				44 J	28	30
MCPA	µg/kg	94746				120 U	89	80
MCPP	µg/kg	93652				123 U	90	78
Mercaptodimethur	µg/kg	2032657						
Mercury Methyl	µg/kg	115093	5.76 UJ	109.25 J	NAR			
Pentachlorophenol	µg/kg	87865				30 U	67	40
Phenol, 2,3,4,6-tetrachl	µg/kg	58902				33 U	73	55
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513				33 U	80	68
Picloram	µg/kg	1918021				61 U	87	75

STATION NUMBER			12A	12A	12A	13	13	13
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Silvex	µg/kg	93721				48 U	93	79
Tetrabutyltin	µg/kg	1461252	11.3 U	65 J	48 J			
Tributyltin chloride	µg/kg	1461229	11.6 U	125 J	117 J			
Trichlopyr	µg/kg	55335063				49 U	99	83

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-16. MS/MSD Organics Measurements of Samples 14 and 2.

STATION NUMBER			14	14	14	2	2	2
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Sample Number			94334300-0	94334300-S1	94334300-S2	95080026-0	95080026-S1	95080026-S2
1,4-Dichlorobenzene	µg/kg	106467				0.28 U	60.24	64.12
1,3-Dinitrobenzene	µg/kg	99650				2 U	105	64
1-Naphthol	µg/kg	90153	4.882 U	NAR	NAR	0.5 U	4.85 U	6.075 U
1,2-Diphenylhydrazine	µg/kg	122667				0.28 U	82.03	82.37
1,2-Dibromo-3-chloropropane	µg/kg	96128	2.3 U	76	86			
1,2-Dichlorobenzene	µg/kg	95501				0.28 U	59.87	63.59
1,3-Dichlorobenzene	µg/kg	541731				0.28 U	57.52	62.35
1,2,4-Trichlorobenzene	µg/kg	120821				0.28 U	58.55	60.34
1,2-Dibromoethane	µg/kg	106934	2.3 U	86	89			
2-Nitrotoluene	µg/kg	88722				2 U	61	16
2,4,5-Trichlorophenol	µg/kg	95954				0.28 U	91.54	95.35
2-Chlorophenol	µg/kg	95578				0.28 U	79.49	88.99
2-Methylphenol	µg/kg	95487				0.28 U	79.64	90.85
2-Chloronaphthalene	µg/kg	91587				0.28 U	68.87	70.11
2-Nitrophenol	µg/kg	88755				0.57 U	88.9	95.11 J
2-Nitroaniline	µg/kg	88744				2.8 U	94.24	102.93
2,4,6-Trichlorophenol	µg/kg	88062				0.28 U	91.74	97.7
2,6-Dinitrotoluene	µg/kg	606202				2 U	70	28
2,4-Dinitrophenol	µg/kg	51285				5.7 U	149.82 J	134.2 J
2,4-Dinitrotoluene	µg/kg	121142				2 U	78	36
2,4-Dichlorophenol	µg/kg	120832				0.28 U	82.45	90.21
2,4-Dimethylphenol	µg/kg	105679				0.28 U	82	89.07
3-Nitroaniline	µg/kg	99092				1.4 U	96.83	98.17
3-OH-Carbofuran	µg/kg	16655826	2.441 U	49.2	79.7	0.5 U	4.625 U	5.875 U
4-Nitrophenol	µg/kg	100027				2.8 U	66.07	69.34
4-Bromophenyl-Phenylether	µg/kg	101553				0.28 U	80.7	78.86
4-Methylphenol	µg/kg	106445				0.28 U	78.15	86.61
4,6-Dinitro-2-methylphenol	µg/kg	534521				5.7 U	119.54	116.36
4-Nitroaniline	µg/kg	100016				0.57 U	71.5 J	64.85 J
4-Chloro-3-methylphenol	µg/kg	59507				0.28 U	88.84	93.81
4-Chlorophenyl-Phenylether	µg/kg	7005723				0.28 U	76.98	74.33
4-Nitrotoluene	µg/kg	99990				2 U	61	17
9H-Fluorene	µg/kg	86737				0.28 U	84.99	84.53
Acenaphthene	µg/kg	83329				0.017 J	79.45	78.21
Acenaphthylene	µg/kg	208968				0.28 U	81.86	80.89
Alachlor	µg/kg	15972608	66.5 U	88	80			
Aldicarb sulfoxide	µg/kg	1646873	2.441 U	54.5	88.4	0.5 U	4.625 U	4.675 U
Aldicarb	µg/kg	116063	2.441 U	54.9	91.9	0.5 U	5.875 U	9.225 U
Aldrin	µg/kg	309002	8.31 U					
Alpha-BHC	µg/kg	319846	8.31 U					
Aniline	µg/kg	62533				0.28 U	73.74	80.62
Anthracene	µg/kg	120127				0.28 U	91.96	92.02
Atrazine	µg/kg	1912249	27.7 U	68	74			
Azinphos-methyl	µg/kg	86500	44.3 U					
Azinphos-ethyl	µg/kg	2642719	44.3 U					

STATION NUMBER			14	14	14	2	2	2
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Benzene, Trinitro-	µg/kg	99354				2 U	67	42
Benzene, 2-methyl-1,3,5-trinitro-	µg/kg	118967				2 U	116	65
Benzene, 1-methyl-3-nitr	µg/kg	99081				2 U	59	17
Benzo [b] fluoranthene	µg/kg	205992				0.28 U	98	103.23
Benzo(a)anthracene	µg/kg	56553				0.28 U	98.41	100.47
Benzo(a)pyrene	µg/kg	50328				0.28 U	100.03	100.6
Benzo(g,h,i)perylene	µg/kg	191242				0.28 U	101.33	103.49
Benzoic acid	µg/kg	65850				5.7 UJ	12.82	52.05
Benzonitrile, 2,6-dichlo	µg/kg	1194656	33.3 U	73	78			
Benzo[k]fluoranthene	µg/kg	207089				0.28 U	95.49	99.01
Benzyl alcohol	µg/kg	100516				0.28 U	75.03	83.02
Beta-BHC	µg/kg	319857	8.31 U					
Bicyclo[2.2.1]hept-5-ene	µg/kg	115286						
bis(2-Chloroisopropyl)ether	µg/kg	39638329				0.28 U	71.94	81.66
bis(2-Chloroethoxy)methane	µg/kg	111911				0.28 U	77.65	85.95
bis(2-Chloroethyl)ether	µg/kg	111444				0.28 U	77.75	87.69
Bis(2-ethylhexyl) phthal	µg/kg	117817				0.28 U	292.13	101.15
Bromacil	µg/kg	314409	166 U	62	61			
Butylbenzylphthalate	µg/kg	85687				0.28 U	99.13	106.07
Butyltin trichloride	µg/kg	1118463	4.6 U	131.61 J	112.9 J			
Carbaryl	µg/kg	63252	2.441 U	47.2	76	0.5 U	4.675 U	6.65 U
Carbofuran	µg/kg	1563662	2.441 U	51.1	86.9	0.5 U	5.9 U	6.925 U
Carbophenothion	µg/kg	786196	27.7 U					
Chlordane (Tech)	µg/kg	57749	111 U					
Chlorpropham (CIPC)	µg/kg	101213	139 U					
Chlorpyrifos-ethyl	µg/kg	5598130	19.4 U					
Chrysene	µg/kg	218019				0.28 U	97.79	101.65
Coumaphos	µg/kg	56724	33.3 U					
Dalapon	µg/kg	75990	89	87	92			
Delta-BHC	µg/kg	319868	8.31 U					
Demeton-s	µg/kg	126750	19.4 U					
Demeton-O	µg/kg	298033	19.4 U					
Di-n-Butylphthalate	µg/kg	84742				0.075 J	93.55	96.31
Di-n-octylphthalate	µg/kg	117840				1.4 U	98.53	99.6
Diazinon	µg/kg	333415	22.2 U					
Dibenzofuran	µg/kg	132649				0.0087 J	86.23	86.98
Dibenz[a,h]anthracene	µg/kg	53703				0.28 U	102.04	103.23
Dibutyltin dichloride	µg/kg	683181	9.3 U	157.56 J	160.8 J			
Dieldrin	µg/kg	60571	16.6 U					
Diethyl phthalate	µg/kg	84662				0.28 U	98.26	101.85
Dimethoate	µg/kg	60515	22.2 U					
Dimethylphthalate	µg/kg	131113				0.28 U	96.15	98.59
Diphenamid	µg/kg	957517	83.1 U	48	64			
Disulfoton	µg/kg	298044	16.6 U					
Endosulfan II	µg/kg	33213659	16.6 U					
Endosulfan Sulfate	µg/kg	1031078	16.6 U					
Endosulfan I	µg/kg	959988	8.31 U					
Endrin Ketone	µg/kg	53494705	16.6 U					

STATION NUMBER			14	14	14	2	2	2
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'
Endrin	µg/kg	72208	16.6 U					
Endrin Aldehyde	µg/kg	7421934	16.6 U					
EPN	µg/kg	2104645	27.7 U					
Ethalfuralin (Sonalan)	µg/kg	55283686	41.6 U	61	57			
Ethion	µg/kg	563122	19.4 U					
Ethoprop	µg/kg	13194484	22.2 U					
Fenithrothion	µg/kg	122145	19.4 U					
Fensulfothion	µg/kg	115902	27.7 U					
Fenthion	µg/kg	55389	19.4 U					
Fluoranthene	µg/kg	206440				0.01 J	93.72	96.73
Fluridone	µg/kg	59756604	222 U	20	17			
Fonophos	µg/kg	944229	16.6 U					
Heptachlor Epoxide	µg/kg	1024573	8.31 U					
Heptachlor	µg/kg	76448	8.31 U					
Hexachlorobenzene	µg/kg	118741				0.28 U	91.61	92.28
Hexachlorobutadiene	µg/kg	87683				0.28 U	52.69	55.68
Hexachloroethane	µg/kg	67721				0.28 U	53.66	58.26
Imidan	µg/kg	732116	30.5 U					
Indeno(1,2,3-cd)pyrene	µg/kg	193395				0.28 U	104.31	108.95
Isophorone	µg/kg	78591				0.28 U	80.92	91.66
Lindane	µg/kg	58899	8.31 U					
Malathion E50	µg/kg	121755	22.2 U					
Mercaptodimethur	µg/kg	2032657	488.2 U	46.4	73.9	1 U	9.125 U	12.4 U
Mercury Methyl	µg/kg	115093	110 U	86	95			
Merphos	µg/kg	150505	44.3 U					
Metholachlor	µg/kg	51218452	83.1 U	79	76			
Methomyl	µg/kg	16752775	2.441 U	53.1	87.3	0.5 U	4 U	4.425 U
Methoxychlor	µg/kg	72435	16.6 U					
Methylene Chloride	µg/kg	75092						
Metribuzin	µg/kg	21087649	27.7 U	55	61			
n-Nitrosodimethylamine	µg/kg	62759				0.28 U	90.67	89.82
n-Nitrosodiphenylamine	µg/kg	86306				0.28 U	92.37	92.92
N-Nitrosodipropylamine	µg/kg	621647				0.28 U	82.22	92.22
Naphthalene, 2-methyl-	µg/kg	91576				0.28 U	72.97	79.54
Naphthalene	µg/kg	91203				0.28 U	67.75	71.5
Napropamide	µg/kg	15299997	83.1 U	74	76			
Nitrobenzene	µg/kg	98953				0.28 NAR	76	31
Norflurazon	µg/kg	27314132	41.6 U	47	37			
Oxyfluorfen	µg/kg	42874033	72.1 U	75	71			
P,P'-DDT	µg/kg	50293	16.6 U					
P,P'-DDD	µg/kg	72548	16.6 U					
P,P'-DDE	µg/kg	72559	16.6 U					
Parathion-methyl	µg/kg	298000	19.4 U					
Parathion	µg/kg	56382	22.2 U					
Pendimethalin	µg/kg	40487421	41.6 U	81	70			
Pentachlorophenol	µg/kg	87865				2.8 U	103.61	106.71
Phenanthrene	µg/kg	85018				0.28 U	88.11	87.34
Phenol	µg/kg	108952				0.28 U	66.41	77.06

STATION NUMBER			14	14	14	2	2	2
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Phorate	µg/kg	298022	19.4 U					
Prometryne	µg/kg	7287196	27.7 U	97	74			
Pronamide (kerb)	µg/kg	23950585	83.1 U	35	52			
Propoxur	µg/kg	114261	2.441 U	51.5	86.8	0.5 U	5.05 U	5.475 U
Pyrene	µg/kg	129000				0.28 U	95.77	97.6
Ramrod	µg/kg	1918167	55.4 U	72	70			
Ronnel	µg/kg	299843	19.4 U					
Simazine	µg/kg	122349	27.7 U	66	65			
Sulfotep	µg/kg	3689245	16.6 U					
Sulprofos	µg/kg	35400432	19.4 U					
Tebuthiuron	µg/kg	34014181	27.7 U	61	65			
Terbacil	µg/kg	5902512	139 U	67	70			
Tetrabutyltin	µg/kg	1461252	4.8 UJ	37.81	J 50.57	J		
Tetryl	µg/kg	479458				2 U	166	57
Toxaphene	µg/kg	8001352	333 U					
Tributyltin chloride	µg/kg	1461229	5 U	178.16	J 186.69	J		
Trifluraline	µg/kg	1582098	41.6 U	62	63			
Vydate	µg/kg	23135220	2.441 U	43.6	67.9	0.5 U	3.85 U	3.975 U

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-17. MS/MSD Organics Measurements of Station 23.

STATION NUMBER			23.0	23.0	23.0	23.0	23.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Sample Number			95080020-0	95080020-S1	95080020-S2	95080020-S3	95080020-S4
1,4-Dichlorobenzene	µg/kg	106467	2.2 U	66.2	83.8		
1,3-Dinitrobenzene	µg/kg	99650	469.7 U	125.0	105.0	NAR	NAR
1,2-Diphenylhydrazine	µg/kg	122667	125.0 U	88.3	86.9		
1,2,3-Trichloropropane	µg/kg	96184	2.2 U	95.2	112.9		
1,2-Dibromo-3-chloropropane	µg/kg	96128	2.2 UJ	60.5 J	56.7		
1,2,4-Trimethylbenzene	µg/kg	95636	2.2 U	83.8	102.8		
1,2-Dichlorobenzene	µg/kg	95501	2.2 U	67.1	84.3		
1,2,3-Trichlorobenzene	µg/kg	87616	2.2 UJ	25.5	30.3		
1,1,2-Trichloroethane	µg/kg	79005	2.2 U	97.3	114.6		
1,2-Dichloropropane	µg/kg	78875	2.2 U	95.7	109.6		
1,1-dichloroethene	µg/kg	75354	2.2 U	113.3	123.0		
1,1-Dichloroethane	µg/kg	75343	2.2 U	96.1	109.5		
1,1,1-Trichloroethane	µg/kg	71556	2.2 U	94.1	105.6		
1,1,1,2-Tetrachloroethane	µg/kg	630206	2.2 UJ	46.7	37.6		
1,1-Dichloropropene	µg/kg	563586	2.2 U	91.0	99.0		
1,3-Dichlorobenzene	µg/kg	541731	2.2 U	70.4	86.2		
1,3-Dichloropropane	µg/kg	142289	2.2 U	79.8	97.8		
1,2,4-Trichlorobenzene	µg/kg	120821	2.2 UJ	31.7 J	36.3		
1,3,5-Trimethylbenzene	µg/kg	108678	2.2 U	86.2	106.4		
1,2-Dichloroethane	µg/kg	107062	2.2 U	85.7	104.5		
1,2-Dibromoethane	µg/kg	106934	2.2 U	61.0	67.8		
2-Nitrotoluene	µg/kg	88722	281.8 U	NAR	NAR	43.0	32.0
2-Chlorotoluene	µg/kg	95498	2.2 U	83.6	100.6		
2,4,5-Trichlorophenol	µg/kg	95954	125.0 U	90.7	89.8		
2-Chlorophenol	µg/kg	95578	125.0 U	89.8	81.5		
2-Methylphenol	µg/kg	95487	125.0 U	90.6	85.6		
2-Chloronaphthalene	µg/kg	91587	125.0 U	86.1	82.6		
2-Nitrophenol	µg/kg	88755	626.0 U	58.5 J	62.2 J		
2-Nitroaniline	µg/kg	88744	626.0 U	84.7	93.5		
2,4,6-Trichlorophenol	µg/kg	88062	250.0 U	93.0	92.8		
2-Hexanone	µg/kg	591786	11.1 UJ	35.2 J	48.3		
2,6-Dinitrotoluene	µg/kg	606202	281.8 U	69.0 NAR	76.2 NAR	71.0	54.0
2,2-Dichloropropane	µg/kg	594207	2.2 U	89.2	107.1		
2-Butanone	µg/kg	78933	24.8 U	NAR	NAR		
2,4-Dinitrophenol	µg/kg	51285	5010.0 UJ	72.3 J	45.9 J		
2,4-Dinitrotoluene	µg/kg	121142	281.8 U	129.0	103.0	NAR	NAR
2,4-Dichlorophenol	µg/kg	120832	125.0 U	92.8	91.5		
2,4-Dimethylphenol	µg/kg	105679	125.0 U	102.1	108.1		
3-Nitroaniline	µg/kg	99092	626.0 UJ	13.0	19.3		
4-Nitrophenol	µg/kg	100027	1250.0 U	105.6 J	103.6 J		
4-Bromophenyl-Phenylether	µg/kg	101553	125.0 U	92.1	90.5		
4-Methylphenol	µg/kg	106445	54.6 J	92.5	89.4		
4,6-Dinitro-2-methylphenol	µg/kg	534521	2500.0 UJ	63.2	41.5		

STATION NUMBER			23.0	23.0	23.0	23.0	23.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
4-Nitroaniline	µg/kg	100016	626.0 UJ	17.5		32.1	
4-Chloro-3-methylphenol	µg/kg	59507	125.0 U	93.5		93.9	
4-Chlorophenyl-Phenylether	µg/kg	7005723	125.0 U	89.9		89.7	
4-Nitrotoluene	µg/kg	99990	281.8 U		NAR		NAR
4-Methyl-2-pentanone	µg/kg	108101	2.2 UJ	28.3		68.5	
4-Chlorotoluene	µg/kg	106434	2.2 U	71.4		92.7	
9H-Fluorene	µg/kg	86737	125.0 U	91.8		90.5	
Acenaphthene	µg/kg	83329	125.0 U	87.2		86.4	
Acenaphthylene	µg/kg	208968	125.0 U	89.3		88.5	
Acetone	µg/kg	67641	31.3 U		NAR		NAR
Alachlor	µg/kg	15972608	265.0 U	95.0		110.0	
Aldrin	µg/kg	309002	23.0 U	119.0		105.0	
Alpha-BHC	µg/kg	319846	23.0 U	104.0		102.0	
Aniline	µg/kg	62533	REJ	1.2		10.7	
Anthracene	µg/kg	120127	125.0 U	90.7		91.5	
Atrazine	µg/Kg	19312249	74.0 U	89.0		93.0	
Azinphos-methyl	µg/kg	86500	118.0 UJ		NAR		NAR
Azinphos-ethyl	µg/kg	2642719	118.0 UJ	27.0		28.0	
Benzene, Trinitro-	µg/kg	99354	469.7 U	172.0		157.0	NAR
Benzene	µg/kg	71432	2.2 U	95.5		109.1	
Benzene, 2-methyl-1,3,5-trinitro-	µg/kg	118967	469.7 U	104.0		75.0	NAR
Benzene, 1-methyl-3-nitr	µg/kg	99081	281.8 U		NAR		NAR
Benzo [b] fluoranthene	µg/kg	205992	125.0 U	95.0		95.0	
Benzo(a)anthracene	µg/kg	56553	125.0 U	92.0		88.2	
Benzo(a)pyrene	µg/kg	50328	125.0 U	86.0		88.0	
Benzo(g,h,i)perylene	µg/kg	191242	125.0 U	71.9		80.6	
Benzoic acid	µg/kg	65850	2500.0 U	105.3	J	116.2	J
Benzonitrile, 2,6-dichlo	µg/kg	1194656	147.0 U	97.0		95.0	
Benzo[k]fluoranthene	µg/kg	207089	125.0 U	92.1		94.8	
Benzyl alcohol	µg/kg	100516	125.0 U	84.9		87.9	
Beta-BHC	µg/kg	319857	23.0 U	74.0		74.0	
bis(2-Chloroisopropyl)ether	µg/kg	39638329	125.0 U	86.0		70.3	
bis(2-Chloroethoxy)methane	µg/kg	111911	125.0 U	83.7		79.1	
bis(2-Chloroethyl)ether	µg/kg	111444	125.0 U	85.2		68.3	
Bis(2-ethylhexyl) phthal	µg/kg	117817	626.0 U	101.6		96.0	
Bromacil	µg/kg	314409	295.0 U	115.0		62.0	
Bromobenzene	µg/kg	108861	2.2 U	75.4		91.4	
Bromochloromethane	µg/kg	74975	2.2 U	124.8		124.5	
Bromodichloromethane	µg/kg	75274	2.2 UJ	15.0		16.6	
Bromoform	µg/kg	75252	REJ	4.1		1.7	
Bromomethane	µg/kg	74839	4.4 UJ	47.7	J	69.3	
Butylbenzylphthalate	µg/kg	85687	626.0 U	104.6		97.5	
Carbon Tetrachloride	µg/kg	56235	2.2 UJ	59.5		49.0	
Carbophenothion	µg/kg	786196	74.0 U	61.0		62.0	

STATION NUMBER			23.0	23.0	23.0	23.0	23.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Chlordane (Tech)	µg/kg	57749	313.0 U	108.0	105.0		
Chlorobenzene	µg/kg	108907	2.2 U	74.2	90.3		
Chloroethane	µg/kg	75003	2.2 U	104.5	113.4		
Chloroform	µg/kg	67663	0.6 J	94.8	103.8		
Chloromethane	µg/kg	74873	2.2 U	126.0	128.5		
Chlorpropham (CIPC)	µg/kg	101213	295.0 U	NAR	NAR		
Chlorpyrifos-ethyl	µg/kg	5598130	59.0 U	67.0	89.0		
Chrysene	µg/kg	218019	125.0 U	105.0	99.6		
cis-1,2-Dichloroethene	µg/kg	156592	2.2 U	87.9	97.8		
Cis-1,3-Dichloropropene	µg/kg	10061015	REJ	11.8	9.9		
Coumaphos	µg/kg	56724	88.0 UJ	NAR	NAR		
Delta-BHC	µg/kg	319868	23.0 U	78.0	73.0		
Demeton-s	µg/kg	126750	103.0 UJ	116.0	117.0		
Demeton-0	µg/kg	298033	103.0 UJ	39.0	47.0		
Di-n-Butylphthalate	µg/kg	84742	856.0 U	93.7	83.0		
Di-n-octylphthalate	µg/kg	117840	626.0 U	92.4	90.6		
Diazinon	µg/kg	333415	59.0 UJ	NAR	NAR		
Dibenzofuran	µg/kg	132649	125.0 U	87.0	89.8		
Dibenz[a,h]anthracene	µg/kg	53703	125.0 U	88.1 J	88.1 J		
Dibromochloromethane	µg/kg	124481	REJ	7.8	5.1		
Dibromomethane	µg/kg	74953	2.2 U	123.8	127.3		
Dichlorodifluoromethane	µg/kg	75718	2.2 U	95.1	104.0		
Dieldrin	µg/kg	60571	47.0 U	116.0	104.0		
Diethyl phthalate	µg/kg	84662	125.0 U	93.8	91.7		
Dimethoate	µg/kg	60515	59.0 UJ	NAR	NAR		
Dimethylphthalate	µg/kg	131113	125.0 U	92.5	90.9		
Diphenamid	µg/kg	957517	221.0 U	53.0	63.0		
Disulfoton	µg/kg	298044	44.0 UJ	63.0	65.0		
Endosulfan II	µg/kg	33213659	47.0 U	103.0	105.0		
Endosulfan Sulfate	µg/kg	1031078	47.0 U	93.0	79.0		
Endosulfan I	µg/kg	959988	23.0 U	103.0	88.0		
Endrin Ketone	µg/kg	53494705	47.0 UJ	92.0	73.0		
Endrin	µg/kg	72208	47.0 U	116.0	99.0		
Endrin Aldehyde	µg/kg	7421934	47.0 UJ	77.0	59.0		
EPN	µg/kg	2104645	74.0 U	56.0	65.0		
Ethalfuralin (Sonalan)	µg/kg	55283686	111.0 U	95.0	99.0		
Ethane, 1,1,2,2-tetrachl	µg/kg	79345	2.2 UJ	85.6 J	114.3		
Ethion	µg/kg	563122	52.0 U	53.0	54.0		
Ethoprop	µg/kg	13194484	59.0 U	NAR	NAR		
Ethylbenzene	µg/kg	100414	2.2 U	76.8	96.4		
Fenithrothion	µg/kg	122145	52.0 U	53.0	61.0		
Fensulfothion	µg/kg	115902	118.0 U	NAR	NAR		
Fenthion	µg/kg	55389	52.0 U	NAR	NAR		
Fluoranthene	µg/kg	206440	44.1 J	86.9	85.9		
Fluridone	µg/kg	59756604	442.0 UJ	11.0	7.0		

STATION NUMBER			23.0	23.0	23.0	23.0	23.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Fonophos	µg/kg	944229	44.0 U	63.0	63.0		
Heptachlor Epoxide	µg/kg	1024573	23.0 U	82.0	82.0		
Heptachlor	µg/kg	76448	23.0 U	99.0	91.0		
Hexachlorobenzene	µg/kg	118741	125.0 U	89.0	88.8		
Hexachlorobutadiene	µg/kg	87683	2.2 U	51.2	53.3		
Hexachloroethane	µg/kg	67721	REJ	8.9	3.6		
Imidan	µg/kg	732116	81.0 UJ	NAR	NAR		
Indeno(1,2,3-cd)pyrene	µg/kg	193395	125.0 U	85.8 J	88.5 J		
Isophorone	µg/kg	78591	125.0 U	86.0	80.4		
Isopropylbenzene	µg/kg	98828	2.2 U	96.4	113.4		
Lindane	µg/kg	58899	23.0 U	101.0	95.0		
Malathion E50	µg/kg	121755	59.0 U	36.0	49.0		
Merphos	µg/kg	150505	88.0 UJ	11.0	15.0		
Metholachlor	µg/kg	51218452	295.0 U	81.0	88.0		
Methoxychlor	µg/kg	72435	47.0 U	66.0	352.0		
Methyl Chlorpyrifos	µg/Kg		59.0 U	56.0	50.0		
Methylene Chloride	µg/kg	75092	11.1 U	98.2	107.0		
Metribuzin	µg/kg	21087649	74.0 U	57.0	65.0		
MP-Xylene	µg/kg		4.4 U	73.8	93.5		
n-Propylbenzene	µg/kg	103651	2.2 U	84.0	101.6		
n-Butylbenzene	µg/kg	104518	2.2 UJ	47.6	72.5		
n-Nitrosodimethylamine	µg/kg	62759	626.0 UJ	69.5	42.9		
n-Nitrosodiphenylamine	µg/kg	86306	125.0 U	92.4	91.0		
N-Nitrosodipropylamine	µg/kg	621647	125.0 U	97.8	85.0		
Naphthalene, 2-methyl-	µg/kg	91576	125.0 U	81.3	81.7		
Naphthalene	µg/kg	91203	2.2 UJ	32.8	41.2		
Napropamide	µg/kg	15299997	221.0 U	78.0	82.0		
Nitrobenzene	µg/kg	98953	469.7 U	119.0	92.0	NAR	NAR
Norflurazon	µg/kg	27314132	147.0 UJ	33.0	26.0		
o-Xylene	µg/kg	95476	2.2 U	74.9	96.1		
Oxyfluorfen	µg/kg	42874033	147.0 U	85.0	88.0		
p-Isopropyltoluene	µg/kg	99876	2.2 U	74.1	95.7		
P,P'-DDT	µg/kg	50293	47.0 UJ	78.0	70.0		
P,P'-DDD	µg/kg	72548	47.0 UJ	90.0	84.0		
P,P'-DDE	µg/kg	72559	47.0 UJ	95.0	90.0		
Parathion-methyl	µg/kg	298000	52.0 U	NAR	NAR		
Parathion	µg/kg	56382	59.0 U	NAR	NAR		
Pendimethalin	µg/kg	40487421	111.0 U	146.0	130.0		
Pentachlorophenol	µg/kg	87865	1250.0 U	91.8	86.6		
Phenanthrene	µg/kg	85018	125.0 U	89.2	88.4		
Phenol	µg/kg	108952	125.0 U	92.0	83.5		
Phenol, 2,3,4,6-tetrachl	µg/kg	58902					
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513					
Phorate	µg/kg	298022	52.0 U	NAR	NAR		
Picloram	µg/kg	1918021					

STATION NUMBER			23.0	23.0	23.0	23.0	23.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Prometryne	µg/kg	7287196	74.0 U	75.0	68.0		
Pronamide (kerb)	µg/kg	23950585	295.0 U	110.0	119.0		
Pyrene	µg/kg	129000	125.0 U	101.5	98.2		
Ramrod	µg/kg	1918167	177.0 U	80.0	84.0		
Ronnel	µg/kg	299843	52.0 U	NAR	NAR		
sec-Butylbenzene	µg/kg	135988	2.2 U	87.7	103.9		
Simazine	µg/kg	122349	74.0 UJ	71.0	70.0		
Styrene	µg/kg	100425	2.2 UJ	27.2	48.0		
Sulfotep	µg/kg	3689245	44.0 U	69.0	68.0		
Sulprofos	µg/kg	35400432	52.0 U	NAR	NAR		
Tebuthiuron	µg/kg	34014181	111.0 U	103.0	95.0		
Terbacil	µg/kg	5902512	221.0 U	133.0	140.0		
Tert-butylbenzene	µg/kg	98066	2.2 U	106.6	113.9		
Tetrachloroethene	µg/kg	127184	2.2 U	78.0	93.6		
Tetryl	µg/kg	479458	469.7 U	NAR	NAR	NAR	NAR
Toluene	µg/kg	108883	2.2 U	80.4	99.1		
Total Xylenes	µg/kg	1330207	4.4 U	74.2	94.3		
Toxaphene	µg/kg	8001352	939.0 U	NAR	NAR		
trans-1,2-Dichloroethene	µg/kg	156605	2.2 U	87.5	96.7		
Trans-1,3-Dichloropropene	µg/kg	10061026	REJ	10.6	9.6		
Trichloroethene	µg/kg	79016	2.2 U	71.9	85.9		
Trichlorofluoromethane	µg/kg	75694	2.2 U	100.6	101.1		
Trifluraline	µg/kg	1582098	111.0 U	142.0	147.0		
Vinyl Chloride	µg/kg	75014	2.2 U	101.4	115.4		

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-18. MS/MSD Organics Measurements of Samples 4 and 5.

STATION NUMBER			4.0	4.0	4.0	5.0	5.0	5.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Sample Number			95080024-0	95080024-S1	95080024-S2	95080021-0	95080021-S1	95080021-S2
1,4-Dichlorobenzene	µg/kg	106467	1.0 U	100.8	102.5			
1-Naphthol	µg/kg	90153				6.3 U	43.9	54.3
1,2,3-Trichloropropane	µg/kg	96184	1.0 U	99.6	103.7			
1,2-Dibromo-3-chloropropane	µg/kg	96128	1.0 U	87.1	82.9			
1,2,4-Trimethylbenzene	µg/kg	95636	1.0 U	100.3	98.3			
1,2-Dichlorobenzene	µg/kg	95501	1.0 U	104.5	102.1			
1,2,3-Trichlorobenzene	µg/kg	87616	1.0 U	76.7	80.0			
1,1,2-Trichloroethane	µg/kg	79005	1.0 U	101.9	100.7			
1,2-Dichloropropane	µg/kg	78875	1.0 U	106.3	101.4			
1,1-dichloroethene	µg/kg	75354	1.0 U	117.1	103.8			
1,1-Dichloroethane	µg/kg	75343	1.0 U	103.6	97.9			
1,1,1-Trichloroethane	µg/kg	71556	1.0 U	98.0	94.6			
1,1,1,2-Tetrachloroethane	µg/kg	630206	1.0 U	95.4	96.0			
1,1-Dichloropropene	µg/kg	563586	1.0 U	102.1	98.4			
1,3-Dichlorobenzene	µg/kg	541731	1.0 U	102.8	100.6			
1,3-Dichloropropane	µg/kg	142289	1.0 U	102.1	101.4			
1,2,4-Trichlorobenzene	µg/kg	120821	1.0 U	83.0	83.8			
1,3,5-Trimethylbenzene	µg/kg	108678	1.0 U	101.3	102.5			
1,2-Dichloroethane	µg/kg	107062	1.0 U	103.5	100.2			
1,2-Dibromoethane	µg/kg	106934	1.0 U	98.8	98.1			
2,4-D	µg/kg	94757	0.2 U	101.0	106.0			
2,4,5-T	µg/kg	93765	0.1 U	84.0	85.0			
2,4,5-TB	µg/kg	93801	0.1 U	97.0	84.0			
2-Chlorotoluene	µg/kg	95498	1.0 U	104.5	100.5			
2,4,5-Trichlorophenol	µg/kg	95954	0.1 U	113.0	137.0			
2,4,6-Trichlorophenol	µg/kg	88062	0.1 U	97.0	74.0			
2-Hexanone	µg/kg	591786	1.0 U	96.8	96.7			
2,2-Dichloropropane	µg/kg	594207	1.0 U	92.0	87.5			
2-Butanone	µg/kg	78933	5.0 U	114.1	111.3			
2,4-DB	µg/kg	94826	0.2 U	83.0	102.0			
3,5-Dichlorobenzoic acid	µg/kg	51365	0.2 U	96.0	90.0			
4-Nitrophenol	µg/kg	100027	0.3 R	0.0	0.0			
4-Methyl-2-pentanone	µg/kg	108101	1.0 U	103.8	104.1			
4-Chlorotoluene	µg/kg	106434	1.0 U	106.9	104.5			
5-Hydroxydicamba	µg/kg	7600502	0.2 U	77.0	125.0			
Acetone	µg/kg	67641	5.0 U	128.7	116.0			
Acifluorfen	µg/kg	50594666	0.7 R	0.0	0.0			
Alachlor	µg/kg	15972608	0.3 U	81.0	79.0			
Aldrin	µg/kg	309002	0.0 U	24.0	17.0			
Alpha-BHC	µg/kg	319846	0.0 U	68.0	73.0			
Atrazine	µg/Kg	19312249	0.1 U	91.0	90.0			
Azinphos-methyl	µg/kg	86500	0.1 U	NAR	NAR			

STATION NUMBER			4.0	4.0	4.0	5.0	5.0	5.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Azinphos-ethyl	µg/kg	2642719	0.1 U	85.0		92.0		
Bentazon	µg/kg	25057890	0.2 U	56.0		44.0		
Benzene	µg/kg	71432	0.1 J	102.3		97.3		
Benzoic acid, 3-amino-2,	µg/kg	133904	0.2 R	0.0		0.0		
Benzonitrile, 2,6-dichlo	µg/kg	1194656	0.2 U	77.0		73.0		
Beta-BHC	µg/kg	319857	0.0 U		NAR	NAR		
Bicyclo[2.2.1]hept-5-ene	µg/kg	115286	0.6 J					
Bromacil	µg/kg	314409	0.4 U	75.0		79.0		
Bromobenzene	µg/kg	108861	1.0 U	101.3		99.6		
Bromochloromethane	µg/kg	74975	1.0 U	111.9		111.4		
Bromodichloromethane	µg/kg	75274	1.0 U	98.8		97.0		
Bromoform	µg/kg	75252	2.0 U	91.9		99.5		
Bromomethane	µg/kg	74839	1.0 U	124.0		108.2		
Bromoxynil	µg/kg	1689845	0.2 U	60.0		45.0		
Carbaryl	µg/kg	63252				3.1 U	61.9	70.3
Carbofuran	µg/kg	1563662				7.2	119.1	125.6
Carbon Tetrachloride	µg/kg	56235	1.0 U	97.5		94.4		
Carbophenothion	µg/kg	786196	0.1 UJ	54.0		89.0		
Chlordane (Tech)	µg/kg	57749	0.4 U					
Chlorobenzene	µg/kg	108907	1.0 U	103.3		101.0		
Chloroethane	µg/kg	75003	1.0 U	146.0		132.6		
Chloroform	µg/kg	67663	1.0 U	101.7		99.1		
Chloromethane	µg/kg	74873	1.0 U	99.5		93.3		
Chlorpropham (CIPC)	µg/kg	101213	0.4 U		NAR	NAR		
Chlorpyrifos-ethyl	µg/kg	5598130	0.1 U	77.0		83.0		
cis-1,2-Dichloroethene	µg/kg	156592	1.0 U	103.0		100.6		
Cis-1,3-Dichloropropene	µg/kg	10061015	1.1 U	97.4		94.9		
Coumaphos	µg/kg	56724	0.1 UJ		NAR	NAR		
Dalapon	µg/kg	75990	0.1 U	43.0		0.0		
DCPA (dacthal)	µg/kg	18611321	0.1 U	108.0		82.0		
Delta-BHC	µg/kg	319868	0.0 U		NAR	NAR		
Demeton-s	µg/kg	126750	0.1 UJ	767.0		775.0		
Demeton-0	µg/kg	298033	0.1 UJ	256.0		232.0		
Diazinon	µg/kg	333415	0.1 U		NAR	NAR		
Dibromochloromethane	µg/kg	124481	1.0 U	97.2		97.1		
Dibromomethane	µg/kg	74953	1.0 U	102.0		100.5		
Dicamba	µg/kg	1918009	0.2 U	126.0		119.0		
Dichlorodifluoromethane	µg/kg	75718	1.0 U	106.2		101.9		
Dichlorprop	µg/kg	120365	0.2 U	107.0		105.0		
Diclofop-methyl	µg/kg	51338273	0.3 U	101.0		94.0		
Dieldrin	µg/kg	60571	0.1 U	73.0		73.0		
Dimethoate	µg/kg	60515	0.1 UJ		NAR	NAR		
Dinoseb	µg/kg	88857	0.2 R	0.0		0.0		
Diphenamid	µg/kg	957517	0.3 U	79.0		94.0		
Disulfoton	µg/kg	298044	0.1 UJ	271.0		227.0		

STATION NUMBER			4.0	4.0	4.0	5.0	5.0	5.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹	Field Sample	Matrix Spike (MS)¹	Matrix Spike Duplicate (MSD)¹
Endosulfan II	µg/kg	33213659	0.1 U		NAR			
Endosulfan Sulfate	µg/kg	1031078	0.1 U	75.0		81.0		
Endosulfan I	µg/kg	959988	0.0 U	72.0		76.0		
Endrin Ketone	µg/kg	53494705	0.1 U	77.0		97.0		
Endrin	µg/kg	72208	0.1 U		NAR		NAR	
Endrin Aldehyde	µg/kg	7421934	0.1 U	74.0		94.0		
EPN	µg/kg	2104645	0.1 U	81.0		96.0		
Ethalfuralin (Sonalan)	µg/kg	55283686	0.1 U	68.0		67.0		
Ethane, 1,1,2,2-tetrachl	µg/kg	79345	1.0 U	101.8		98.1		
Ethion	µg/kg	563122	0.1 U	72.0		97.0		
Ethoprop	µg/kg	13194484	0.1 U		NAR		NAR	
Ethylbenzene	µg/kg	100414	1.0 U	102.0		100.1		
Fenithrothion	µg/kg	122145	0.1 UJ	73.0		86.0		
Fensulfothion	µg/kg	115902	0.1 UJ		NAR		NAR	
Fenthion	µg/kg	55389	0.1 U		NAR		NAR	
Fluridone	µg/kg	59756604	1.0 UJ	151.0		89.0		
Fonophos	µg/kg	944229	0.1 U	85.0		78.0		
Heptachlor Epoxide	µg/kg	1024573	0.0 U	70.0		79.0		
Heptachlor	µg/kg	76448	0.0 U	44.0		33.0		
Hexachlorobutadiene	µg/kg	87683	1.0 U	98.3		93.6		
Hexachloroethane	µg/kg	67721						
Imidan	µg/kg	732116	0.1 U		NAR		NAR	
Ioxynil	µg/kg	1689834	0.2 U	37.0		38.0		
Isopropylbenzene	µg/kg	98828	1.0 U	103.7		102.6		
Lindane	µg/kg	58899	0.0 U		NAR		NAR	
Malathion E50	µg/kg	121755	0.1 U	81.0		86.0		
MCPA	µg/kg	94746	0.3 U	113.0		120.0		
MCPP	µg/kg	93652	0.3 U	97.0		103.0		
Mercaptodimethur	µg/kg	2032657					21.9	52.3
Merphos	µg/kg	150505	0.1 U	58.0		72.0		70.1
Metholachlor	µg/kg	51218452	0.4 U	88.0		82.0		
Methoxychlor	µg/kg	72435	0.1 U	53.0		83.0		
Methyl Chlorpyrifos	µg/Kg		0.1 U	84.0		82.0		
Methylene Chloride	µg/kg	75092	1.0 U	203.9		179.3	J	
Metribuzin	µg/kg	21087649	0.1 U	85.0		54.0		
MP-Xylene	µg/kg		2.0 U	101.2		99.4		
n-Propylbenzene	µg/kg	103651	1.0 U	101.4		97.8		
n-Butylbenzene	µg/kg	104518	1.0 U	101.2		97.6		
Naphthalene	µg/kg	91203	1.0 U	76.7		78.1		
Napropamide	µg/kg	15299997	0.3 U	99.0		120.0		
Norflurazon	µg/kg	27314132	0.2 UJ	95.0		90.0		
o-Xylene	µg/kg	95476	1.0 U	101.4		98.9		
Oxyfluorfen	µg/kg	42874033	0.2 U	69.0		82.0		
p-Isopropyltoluene	µg/kg	99876	1.0 U	98.8		97.7		
P,P'-DDT	µg/kg	50293	0.1 U	0.0			NAR	

STATION NUMBER			4.0	4.0	4.0	5.0	5.0	5.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
P,P'-DDD	µg/kg	72548	0.1 U	60.0		81.0		
P,P'-DDE	µg/kg	72559	0.1 U	79.0		85.0		
Parathion-methyl	µg/kg	298000	0.1 U		NAR	NAR		
Parathion	µg/kg	56382	0.1 U		NAR	NAR		
Pendimethalin	µg/kg	40487421	0.1 U	77.0		70.0		
Pentachlorophenol	µg/kg	87865	0.0 J	102.0		109.0		
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	0.1 U	108.0		105.0		
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	0.1 U	107.0		113.0		
Phorate	µg/kg	298022	0.1 U		NAR	NAR		
Picloram	µg/kg	1918021	0.2 U	55.0		113.0		
Prometryne	µg/kg	7287196	0.1 U	81.0		98.0		
Pronamide (kerb)	µg/kg	23950585	0.4 U	77.0		81.0		
Propoxur	µg/kg	114261				3.1 U	136.6	151.3
Ramrod	µg/kg	1918167	0.2 U	82.0		84.0		
Ronnel	µg/kg	299843	0.1 U		NAR	NAR		
sec-Butylbenzene	µg/kg	135988	1.0 U	103.3		99.3		
Silvex	µg/kg	93721	0.1 U	101.0		108.0		
Simazine	µg/kg	122349	0.1 UJ	103.0		101.0		
Styrene	µg/kg	100425	1.0 U	100.7		95.9		
Sulfotep	µg/kg	3689245	0.1 U	83.0		81.0		
Sulprofos	µg/kg	35400432	0.1 U		NAR	NAR		
Tebuthiuron	µg/kg	34014181	0.1 U	91.0		83.0		
Terbacil	µg/kg	5902512	0.3 U	62.0		59.0		
Tert-butylbenzene	µg/kg	98066	1.0 U	101.7		99.2		
Tetrachloroethene	µg/kg	127184	1.0 U	100.2		99.5		
Toluene	µg/kg	108883	1.0 U	104.3		101.6		
Total Xylenes	µg/kg	1330207	2.0 U	101.3		99.2		
Toxaphene	µg/kg	8001352	1.1 U		NAR	75.0		
trans-1,2-Dichloroethene	µg/kg	156605	1.0 U	103.0		97.8		
Trans-1,3-Dichloropropene	µg/kg	10061026	0.9 U	93.7		93.8		
Trichlopyr	µg/kg	55335063	0.1 U	97.0		86.0		
Trichloroethene	µg/kg	79016	1.0 U	101.2		98.1		
Trichlorofluoromethane	µg/kg	75694	1.0 U	122.9		121.1		
Trifluraline	µg/kg	1582098	0.1 U	66.0		66.0		
Vinyl Chloride	µg/kg	75014	1.0 U	107.7		103.2		

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-19. MS/MSD Organics Measurements of Sample 7.

STATION NUMBER			7.0	7.0	7.0	7.0	7.0	7.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'	Field Sample	Matrix Spike (MS)'	Matrix Spike Duplicate (MSD)'
Sample Number			95240104-0	95240104-S1	95240104-S2	95240103-0	95240103-S1	95240103-S2
2,4-D	µg/kg	94757	0.1		42.9	109.7		
2,4,5-T	µg/kg	93765	0.1	U	47.4	128.9		
2,4,5-TB	µg/kg	93801	0.1	U	57.1	117.8		
2,4,5-Trichlorophenol	µg/kg	95954	0.1	U	82.2	84.9		
2,4,6-Trichlorophenol	µg/kg	88062	0.1	U	54.2	81.9		
2,4-DB	µg/kg	94826	0.2	U	52.1	104.6		
3,5-Dichlorobenzoic acid	µg/kg	51365	0.1	U	47.5	62.7		
4-Nitrophenol	µg/kg	100027			8.6	10.9		
5-Hydroxydicamba	µg/kg	7600502	0.0	R	0.9	1.5		
Acifluorfen (Blazer)	µg/kg	62476599	0.5	U	32.0	22.7		
Alachlor	µg/kg	15972608					0.3	U
Alpha-BHC	µg/kg	319846					0.0	U
Atrazine	µg/kg	1912249					0.1	U
Azinphos-methyl	µg/kg	86500					0.2	
Azinphos-ethyl	µg/kg	2642719					0.1	U
Bentazon	µg/kg	25057890	0.2	UJ	16.2	27.3		
Benzoic acid, 3-amino-2,	µg/kg	133904	0.1	UJ	18.0	3.3		
Benzonitrile, 2,6-dichlo	µg/kg	1194656					1.9	
Beta-BHC	µg/kg	319857					0.0	U
Bromacil	µg/kg	314409					0.3	U
Bromoxynil	µg/kg	1689845	0.1	U	46.7	40.0		
Carbophenothion	µg/kg	786196					0.1	U
Chlordane (Tech)	µg/kg	57749					0.3	U
Chlorpropham (CIPC)	µg/kg	101213					0.1	J
Chlorpyrifos	µg/kg	2921882					0.0	J
Coumaphos	µg/kg	56724					0.1	UJ
Dalapon	µg/kg	75990	0.0	R	0.4	2.2		
DCPA	µg/kg	1861321	0.1	UJ	5.7	4.2		
Delta-BHC	µg/kg	319868					0.0	U
Demeton-s	µg/kg	126750					0.1	UJ
Demeton-0	µg/kg	298033					0.1	U
Diazinon	µg/kg	333415					0.2	
Dicamba	µg/kg	1918009	0.1	UJ	4.2	43.6		
Dichlorprop	µg/kg	120365	0.1	U	62.1	112.6		
DICLOFOP-METHYL	µg/kg	51338273	0.2	U	76.9	120.6		
Dieldrin	µg/kg	60571					0.0	U
Dimethoate	µg/kg	60515					0.1	U
Dinoseb	µg/kg	88857	0.2	U	33.8	29.1		
Diphenamid	µg/kg	957517					0.2	U
Disulfoton	µg/kg	298044					0.3	U
Endosulfan II	µg/kg	33213659					0.0	U
Endosulfan Sulfate	µg/kg	1031078					0.0	U

STATION NUMBER			7.0	7.0	7.0	7.0	7.0	7.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Endosulfan I	µg/kg	959988				0.0 U	87.5	86.8
Endrin Ketone	µg/kg	53494705				0.0 U	89.1	91.9
Endrin	µg/kg	72208				0.0 U	90.3	91.0
Endrin Aldehyde	µg/kg	7421934				0.0 U	63.7	64.4
EPN	µg/kg	2104645				0.1 U	105.3	105.5
Ethalfuralin (Sonalan)	µg/kg	55283686				0.1 U	84.9	84.5
Ethane, 1,1,2,2-tetrachl	µg/kg	79345						
Ethion	µg/kg	563122				0.1 U	89.0	87.1
Ethoprop	µg/kg	13194484				0.1 U		
Ethylbenzene	µg/kg	100414						
Fenithrothion	µg/kg	122145				0.1 U	110.6	111.7
Fensulfothion	µg/kg	115902				0.1 UJ		
Fenthion	µg/kg	55389				0.0 U		
Fluoranthene	µg/kg	206440						
Fluridone	µg/kg	59756604				0.5 UJ	39.3	42.6
Fonophos	µg/kg	944229				0.0 U		
Heptachlor Epoxide	µg/kg	1024573				0.0 U	84.2	86.4
Imidan	µg/kg	732116				0.1 UJ		
Ioxynil	µg/kg	1689834	0.1 U	42.3	39.7			
Lindane	µg/kg	58899				0.0 U	100.0	101.8
Malathion E50	µg/kg	121755				0.1 U	133.5	133.3
MCPA	µg/kg	94746	0.3 U	47.2	106.6			
MCPP	µg/kg	93652	0.3 U	60.8	101.8			
Merphos	µg/kg	150505				0.1 UJ	73.6	120.4
Metholachlor	µg/kg	51218452				0.3 U	73.7	72.3
Methoxychlor	µg/kg	72435				0.0 U	89.2	92.2
Methyl Chlorpyrifos	µg/Kg						114.1	115.4
Metribuzin	µg/kg	21087649				0.1 U	86.1	84.4
Napropamide	µg/kg	15299997				0.2	101.0	98.0
Norflurazon	µg/kg	27314132				1.0	64.0	62.0
Oxyfluorfen	µg/kg	42874033				0.3 U		
P,P'-DDT	µg/kg	50293				0.1 U	90.7	91.8
P,P'-DDD	µg/kg	72548				0.0 J	89.5	92.1
P,P'-DDE	µg/kg	72559				0.0 U	69.6	69.2
Parathion-methyl	µg/kg	298000				0.1 U		
Parathion	µg/kg	56382				0.0 U		
Pendimethalin	µg/kg	40487421				0.1 U	67.9	60.9
Pentachlorophenol	µg/kg	87865	0.0 U	82.0	103.6			
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	0.1 U	35.5	98.1			
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	0.1 U	91.5	111.5			
Picloram	µg/kg	1918021	0.0 R	0.6	8.5			
Pronamide (kerb)	µg/kg	23950585				0.3 U	93.9	87.0
Ramrod	µg/kg	1918167				0.2 U	90.3	87.7
Ronnel	µg/kg	299843				0.1 U		
Silvex	µg/kg	93721	0.1 U	66.6	115.3			

STATION NUMBER			7.0	7.0	7.0	7.0	7.0	7.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Simazine	µg/kg	122349				0.0	UJ	143.0
Sulfotep	µg/kg	3689245				0.0	U	136.0
Sulprofos	µg/kg	35400432				0.1	U	
Tebuthiuron	µg/kg	34014181				0.1	U	64.4
Terbacil	µg/kg	5902512				0.2	U	78.8
Toxaphene	µg/kg	8001352				1.6	U	
Trichlopyr	µg/kg	55335063	0.0	J	55.3	111.7		
Trifluraline	µg/kg	1582098				0.1	U	63.5

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-20. MS/MSD Organics Measurements of Sample 8.

STATION NUMBER			8		8.0		8.0	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Sample Number			95240107-0		95240107-S1		95240107-S2	
2,4-D	µg/kg	94757	42	UJ	70.6		74.6	
2,4,5-T	µg/kg	93765	34	UJ	67.8		74.4	
2,4,5-TB	µg/kg	93801	38	UJ	74.7		79.5	
2,4,5-Trichlorophenol	µg/kg	95954	25	UJ	65.3		61.1	
2,4,6-Trichlorophenol	µg/kg	88062	25	UJ	61.7		65.6	
2,4-DB	µg/kg	94826	51	UJ	67.8		71.7	
3,5-Dichlorobenzoic acid	µg/kg	51365	42	UJ	64.8		67.7	
4-Nitrophenol	µg/kg	100027	230	UJ	112.0		179.0	
5-Hydroxydicamba	µg/kg	7600502	42	UJ	73.5		62.8	
Acifluorfen	µg/kg	50594666	170	UJ	39.5		38.2	
Alachlor	µg/kg	15972608	62	U	98.3		88.1	
Aldrin	µg/kg	309002	10	U	95.4		79.7	
Alpha-BHC	µg/kg	319846	10	U	104.1		90.2	
Atrazine	µg/kg	1912249	17	U	65.3		53.9	
Azinphos-methyl	µg/kg	86500	28	U	90.2		88.3	
Azinphos-ethyl	µg/kg	2642719	28	UJ				
Bentazon	µg/kg	25057890	63	UJ	73.8		87.0	
Benzoic acid, 3-amino-2,	µg/kg	133904	42	UJ	24.2		17.0	
Benzonitrile, 2,6-dichlo	µg/kg	1194656	1.5	NJ	81.6		67.1	
Beta-BHC	µg/kg	319857	10	U	128.2		118.1	
Bromacil	µg/kg	314409	70	U	77.5		70.2	
Bromoxynil	µg/kg	1689845	42	UJ	51.3		60.7	
Carbophenothion	µg/kg	786196	17	U				
Chlordane (Tech)	µg/kg	57749	70	U				
Chlorpropham (CIPC)	µg/kg	101213	70	U				
Chlorpyrifos	µg/kg	2921882	12	U				
Chlorpyrifos-ethyl	µg/kg	5598130	12	U				
Coumaphos	µg/kg	56724	21	UJ	110.2		111.6	
Dalapon	µg/kg	75990	850	UJ	79.1		95.0	
DCPA	µg/kg	1861321	34	UJ	70.4		71.5	
Delta-BHC	µg/kg	319868	10	U	117.9		106.4	
Demeton-s	µg/kg	126750	12	U				
Demeton-O	µg/kg	298033	12	U				
Diazinon	µg/kg	333415	14	U	153.7		137.9	
Dicamba	µg/kg	1918009	34	UJ	71.6		73.5	
Dichlorprop	µg/kg	120365	46	UJ	76.8		82.3	
Diclofop-methyl	µg/kg	51338273	63	UJ	61.5		70.0	
Dieldrin	µg/kg	60571	10	U	104.3		93.5	
Dimethoate	µg/kg	60515	14	U	64.6		42.7	
Dinoseb	µg/kg	88857	150	UJ	56.9		53.2	
Diphenamid	µg/kg	957517	52	U	88.5		68.2	
Disulfoton	µg/kg	298044	10	U				

STATION NUMBER			8	8.0	8.0
Target Compound	Units	CAS #	Field Sample	Matrix Spike (MS) ¹	Matrix Spike Duplicate (MSD) ¹
Endosulfan II	µg/kg	33213659	10 U	113.6	101.6
Endosulfan Sulfate	µg/kg	1031078	10 U	101.2	93.3
Endosulfan I	µg/kg	959988	10 U	115.7	101.8
Endrin Ketone	µg/kg	53494705	10 U	54.0	56.6
Endrin	µg/kg	72208	10 U	112.2	99.6
Endrin Aldehyde	µg/kg	7421934	10 U	70.5	57.0
EPN	µg/kg	2104645	17 U		
Ethalfuralin (Sonalan)	µg/kg	55283686	26 U	91.8	90.5
Ethion	µg/kg	563122	12 U		
Ethoprop	µg/kg	13194484	14 U	123.2	109.2
Fenithrothion	µg/kg	122145	12 U		
Fensulfothion	µg/kg	115902	17 UJ	137.6	127.1
Fenthion	µg/kg	55389	12 U	127.0	99.8
Fluridone	µg/kg	59756604	100 UJ	81.3	65.2
Fonophos	µg/kg	944229	10 U		
Heptachlor Epoxide	µg/kg	1024573	10 U	113.3	105.3
Heptachlor	µg/kg	76448	10 U	50.2	48.4
Imidan	µg/kg	732116	19 UJ	116.5	110.9
Ioxynil	µg/kg	1689834	42 UJ	39.7	49.0
Lindane	µg/kg	58899	10 U	96.5	90.1
Malathion E50	µg/kg	121755	14 U		
MCPA	µg/kg	94746	85 UJ	83.5	88.1
MCPP	µg/kg	93652	85 UJ	88.8	91.5
Merphos	µg/kg	150505	28 UJ		
Metholachlor	µg/kg	51218452	70 U	79.0	76.4
Methoxychlor	µg/kg	72435	10 UJ	26.0	26.2
Metribuzin	µg/kg	21087649	17 U	71.3	55.7
Napropamide	µg/kg	15299997	52 U	111.6	95.8
Norflurazon	µg/kg	27314132	35 U	99.2	90.4
Oxyfluorfen	µg/kg	42874033	70 U		
P,P'-DDT	µg/kg	50293	10 UJ	24.4	25.5
P,P'-DDD	µg/kg	72548	3 NJ	150.4	132.9
P,P'-DDE	µg/kg	72559	10 U	129.3	111.6
Parathion-methyl	µg/kg	298000	12 U	111.8	108.5
Parathion	µg/kg	56382	14 U	145.9	137.9
Pendimethalin	µg/kg	40487421	26 U	72.8	61.8
Pentachlorophenol	µg/kg	87865	20 UJ	73.2	82.6
Phenol, 2,3,4,6-tetrachl	µg/kg	58902	23 UJ	66.2	73.8
Phenol, 2,3,4,5-tetrachl	µg/kg	4901513	23 UJ	67.5	75.2
Phorate	µg/kg	298022	12 U	133.3	99.5
Picloram	µg/kg	1918021	42 UJ	56.0	55.4
Prometryne	µg/kg	7287196	17 UJ	53.2	38.8
Pronamide (kerb)	µg/kg	23950585	70 UJ	4.7	20.9
Ramrod	µg/kg	1918167	42 U	100.1	86.6
Ronnel	µg/kg	299843	12 U	111.6	107.3

STATION NUMBER			8		8.0		8.0	
Target Compound	Units	CAS #	Field Sample		Matrix Spike (MS) ¹		Matrix Spike Duplicate (MSD) ¹	
Silvex	µg/kg	93721	34	UJ	90.3		91.2	
Simazine	µg/kg	122349	17	UJ	119.2		95.9	
Sulfotep	µg/kg	3689245	10	U				
Sulprofos	µg/kg	35400432	12	U	131.5		102.8	
Tebuthiuron	µg/kg	34014181	26	U	79.5		62.6	
Terbacil	µg/kg	5902512	52	U	104.6		102.7	
Toxaphene	µg/kg	8001352	350	U				
Trichlopyr	µg/kg	55335063	34	UJ	70.4		75.6	
Trifluraline	µg/kg	1582098	26	U	81.0		79.2	

¹ Measurement values reported in this column are units of percent recovery of target compound spiked in matrix sample.

Table E-21. Blind Duplicate Inorganic Measurements in Drinking Water Samples

STATION	CAS NUMBER	METHOD		35		35		Precision
LOCATION				Reservation Dexter		Reservation Dexter		
EPA NUMBER				95430516		95430517 Lab Duplicate		
SOURCE				outdoor tap		outdoor tap		
				µg/l		µg/l		Percent Difference
Aluminum	7429905	ICP/SAS	200.7	20	U	20	U	0.0
Antimony	7440360	ICP/MS	200.8	0.5	U	0.5	U	0.0
Arsenic	7440382	ICP/MS	200.8	5.3		5.28		0.4
Barium	7440393	ICP/SAS	200.7	2	U	2	U	0.0
Beryllium	7440417	ICP/SAS	200.7	0.5	U	0.5	U	0.0
Boron	7440428	ICP/SAS	200.7	16	P	17	P	6.1
Cadmium	7440439	ICP/SAS	200.7	2	U	2	U	0.0
Calcium	7440702	ICP/SAS	200.7	16100		16100		0.0
Chromium	7440473	ICP/SAS	200.7	5	U	5	U	0.0
Cobalt	7440484	ICP/SAS	200.7	10	U	10	U	0.0
Copper	7440508	ICP/MS	200.8	1.3	P	1.3	P	0.0
Iron	7439896	ICP/SAS	200.7	10	U	10	U	0.0
Lead	7439921	ICP/MS	200.8	0.5	U	0.5	U	0.0
Magnesium	7439954	ICP/SAS	200.7	5590		5560		0.5
Manganese	7439965	ICP/SAS	200.7	1.1	P	1	U	9.5
Mercury	7439976	CVAA	200.8	0.2	U	0.2	U	0.0
Molybdenum	7439987	ICP/SAS	200.7	5	U	5	U	0.0
Nickel	7440020	ICP/SAS	200.7	10	U	10	U	0.0
Potassium	7440097	ICP/SAS	200.7	1900	P	2000		5.1
Selenium	7782492	ICP/MS	200.8	2	U	2	U	0.0
Silica	7631869	ICP/SAS	200.7	25200		25100		0.4
Silver	7440224	ICP/SAS	200.7	3	U	3	U	0.0
Sodium	7440235	ICP/SAS	200.7	9800		9740		0.6
Thallium	7440280	ICP/MS	200.8	1	U	1	U	0.0
Vanadium	7440622	ICP/SAS	200.7	8.3	P	8	P	3.7
Zinc	7440666	ICP/SAS	200.7	7.7	P	9.6	P	22.0
AVERAGE PERCENT DIFFERENCE FOR METALS MEASUREMENTS								±2%
UNITS				mg/l		mg/l		Percent Difference
Alkalinity		Titrimetry	310.1	73.1		60		19.7
Chloride		Ion Chrom.	300.0	11.6		11.6		0.0
Fluoride		Ion Chrom.	300.0	0.192		0.193		0.5
Ammonia, N		Colorimetry	350.1	0.2	HJN	0.16	HJN	22.2
Nitrate+Nitrite, N		Colorimetry	353.2	0.036		0.04		10.5
Tot Phosphorus		Colorimetry	365.1	0.244		0.208		15.9
Sulfate		Ion Chrom.	300.0	5.06		5.07		0.2
Temperature		Electrometry		13.2		13.2		0.0
pH, field		Electrometry		8.69		8.69		0.0
Conductivity		Electrometry		169		169		0.0

Table E-22. Laboratory Duplicate Inorganics Measurements of Dump Site Samples

Station Number	2	2	Precision	4	4	Precision
Location	Dump Site, Leachate	Dump Site, Leachate, Lab Dupl.		FW Stream, Below Dump Site	FW Stream, Below Dump Site Lab Dupl.	
EPA Sample Number	95080026	95080026		95080024	95080024	
Media	Water	Water		Water	Water	
Metals Measurements						
Units	µg/l		µg/l		Percent Difference	
Aluminum	36.9	BN				
Arsenic	1	U				
Barium	195					
Beryllium	0.3	U				
Cadmium	0.52	P				
Calcium	101000					
Chromium	1	U				
Copper	2	P				
Iron	8010					
Lead	1.93	B				
Magnesium	12700					
Manganese	141					
Mercury	0.1	U				
Nickel	13					
Potassium	8950					
Sodium	25800					
Zinc	237					
Average Percent Difference						±7
General Chemistry Measurements:						
Units	mg/l		mg/l		Percent Difference	
Alkalinity	263		263		0	
Ammonia	0.052	J	0.087	J	50	
Chloride	41.9		39.5		6	
Fluoride	0.067		0.067		0	
Nitrate+Nitrite	1.22		1.23		1	
Sulfate	51.4		51.4		0	

Table E-23. Laboratory Duplicate Inorganics Measurements of Cranberry Bog Samples

Station Number	6	6	Precision	7	7	Precision					
Location	Upper Cranberry Ditch	Upper Cranberry Ditch		Upper Cranberry Ditch	Upper Cranberry Ditch						
EPA Sample Number	95240100 95240101	95240100 95240101 Lab Duplicate		95240103 95240105 95240104 95240102	95240103 95240105 95240104 95240102 Lab Duplicate						
Media	Sediment	Sediment		Water	Water						
Metals Measurements											
Units	mg/kg		mg/kg		Percent Difference	µg/l		µg/l		Percent Difference	
Aluminum	6050		5970		1	67	P	66	P	2	
Arsenic	10	U	24	P		6.42	N	6.35	N	1	
Barium	14.4		15.1		5	3.4	P	3.3	P	3	
Beryllium	0.229		0.252		10	0.3	U	0.3	U	0	
Calcium	1660		1500		10	7270		7370		1	
Chromium	11.2		11.6		4	1	U	1	U	0	
Cobalt	3.94		4.03		2	10	U	10	U	0	
Copper	5.25		5.41		3	3	U	3	U	0	
Iron	20300		20400		0	4710		4730		0	
Lead	3.7	P	1.0	U		0.5	U	0.5	U	0	
Magnesium	3090		3120		1	5510		5550		1	
Manganese	130		131		1	104		105		1	
Nickel	8.57		9.02		5	0.3	U	0.3	U	0	
Potassium	358		350		2	3610		3200		12	
Selenium	10	P	3.2	U		2	U	2	U	0	
Silver	0.44	P	0.12	U		0.1	UNE	0.1	UNE	0	
Sodium	132		132		0	24600		24700		0	
Vanadium	27.4		26.5		3	3.3	P	3.0	P	10	
Zinc	35.3		35.5		1	7	PB	9.6	PB	31	
Average Percent Difference					±3	Average Percent Difference					±3
General Chemistry Measurements:											
Station Number	6	6	Precision	9	9	Precision					
Units	mg/l		mg/l		Percent Difference	mg/l		mg/l		Percent Difference	
Alkalinity						54.3		53.7			
Chloride						269					
Fluoride						0.106					
Kjel-Nitrogen						0.371	J	0.339	J		
Ammonia						0.074		0.073			
Nitrate/Nitrite						0.085		0.167			
Total Phosphorus						0.245		0.298			
Sulfate						40.1					

Table E- 24. Laboratory Duplicate Metals Measurements of Cranberry Bog Samples

Station Number	23	23	Precision
Location	Grays Harbor, South Bay	Grays Harbor, South Bay	
EPA Sample Number	Sediment	Sediment	
Media	95080020	95080020	
Metals Measurements			
Units	mg/kg	mg/kg	Percent Difference
Aluminum	15100	14000	8
Arsenic	14.4	14.2	1
Barium	23.3	22.8	2
Beryllium	0.808	0.771	5
Calcium	3850	3730	3
Chromium	30.4	29.4	3
Copper	28.4	28.2	1
Iron	36100	35100	3
Lead	13.7	13.0	5
Magnesium	7380	7220	2
Manganese	145	141	3
Nickel	19.6	18.9	4
Potassium	2680	2630	2
Sodium	13300	13200	1
Average Percent Difference			3

Appendix F: DATA QUALIFIERS USED TO VALIDATE ORGANICS DATA

The following qualifiers were used for organics measurement data attached to this Report:

U - The analyte was analyzed for, but was not detected above the sample quantitation limit. The associated numerical value is based upon the lowest calibration point of the 5-point initial calibration curve and any dilutions which were made to the sample due to high concentrations or matrix effects.

If a decision requires quantitation of the analyte below the associated numerical level, reanalysis or alternative analytical methods should be considered. The technical staff is available to discuss available options.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision making and are useable for many purposes.

A subscript may be appended to the "J" that indicates which of the following quality control criteria were not met:

- 1 Blank Contamination: indicates possible high bias and/or false positives.
- 2 Calibration range exceeded: indicates possible low bias.
- 3 Holding times not met: indicates low bias for most analytes with the exception of common laboratory contaminants and chlorinated ethenes (i.e. trichloroethene, 1,1-dichloroethene, vinyl chloride).
- 4 Other QC outside control limits: bias not readily determined.

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Resampling and reanalysis are necessary to confirm or deny the presence of the analyte.

UJ - The analyte was analyzed for and was not detected above the reported quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in this sample.

If a decision requires quantitation of the analyte close to the associated numerical level, reanalysis or alternative analytical methods should be considered.

N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.

Confirmation of the analyte requires further analysis.

NJ - A combination of the "N" and the "J" qualifier. The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

A subscript may be appended to the "NJ" that indicates which of the following situations applies:

- 1 DDT/Endrin breakdown evident.
- 2 Interference from other sample components.
- 3 Non-Target Compound List (TCL) organic compounds (Confirmation is necessary using specific target compound methodology to accurately determine the concentration and identity of the detected compounds.)
- 4 A confirmation analysis was missing or quality control criteria were not met for the confirmation analysis.

NAF - Not analyzed for.

NAR - No analytical result.

***** - The analyte was present in the sample. This is a visual aid to locate detected compounds on the report sheet.

Appendix G: DATA QUALIFIERS USED TO VALIDATE INORGANICS DATA

The following qualifiers were used for inorganics measurement data attached to this Report:

U - Element was analyzed but not detected. The associated numerical value is the method detection limit, as defined in 40 CFR Part 136, Appendix B.

P - The analyte was detected above the Instrument Detection Limit, but not quantified within the expected limits of precision. The laboratory has established minimum quantitation limits having a relative standard deviation of no more **than** 10%.

H - The samples were analyzed after the suggested holding time limit.

E - The reported value is an estimate because of the presence of an interference. An explanatory note is provide in the data validation report.

B - Analyte is found in the analytical blank as well as the sample indicating possible/probable blank contamination. If analytes are found in any of the associated procedural blanks the concentration in the samples must be at least ten times the quantity observed in the blank. If the sample result fails these criteria the sample result is qualified (B).

N - Spiked sample recovery not within control limits.

NAR - There is no analysis result for this sample.

S - Sample was analyzed by method of standard additions.

+ - Sample was analyzed by method of standard additions and the correlation coefficient was less than 0.995.

***** - The analyte was present in the sample.

W - Post spike out of specified range, and sample was less than 50% the spike added.

Appendix H: GPS READINGS FOR PROJECT SAMPLES

Table H-1. GPS coordinates for stations 1 to 14 and 20 to 23, and for the drinking water survey.

Station No.	Media	Latitude-North	Longitude-West
1	Sediment	46° 43' 42.087"	124° 03' 03.991"
2	Water	46° 43' 42.087"	124° 03' 03.991"
3	Sediment	46° 43' 40.009"	124° 03' 03.082"
4	Water	46° 43' 40.009"	124° 03' 03.082"
5	Sediment	46° 43' 37.005"	124° 03' 02.421"
6	Sediment	46° 44' 13.639"	124° 04' 07.103"
7	Water	46° 44' 13.639"	124° 04' 07.103"
8	Sediment	46° 43' 57.289"	124° 03' 40.835"
9	Water	46° 43' 57.289"	124° 03' 40.835"
10	Sediment	46° 40' 54.8"	123° 55' 51.5"
11	Sediment	46° 40' 51.4"	123° 55' 42.0"
12 and 12A	Sediment	46° 43' 20.365"	124° 01' 05.866"
13	Sediment	46° 43' 28.0"	123° 56' 20.8"
14	Sediment	46° 41' 30.9"	123° 57' 48.8"
20	Razor Clams	46° 42' 50.885"	124° 01' 49.353"
21	Oysters	46° 43' 13.077"	123° 57' 56.809"
22	Littleneck Clams	46° 43' 08.212"	124° 01' 09.727"
23	Sediment	46° 51' 32.826"	124° 05' 06.766"
1	Drinking Water	N/A	N/A
2	Drinking Water	N/A	N/A
3	Drinking Water	N/A	N/A
4	Drinking Water	N/A	N/A
5	Drinking Water	N/A	N/A
6	Drinking Water	N/A	N/A
7	Drinking Water	N/A	N/A
8	Drinking Water	46° 43' 21.712"	124° 00' 59.674"
9	Drinking Water	46° 43' 22.815"	124° 01' 05.811"
10	Drinking Water	N/A	N/A
12	Drinking Water	N/A	N/A
14	Drinking Water	N/A	N/A
15	Drinking Water	N/A	N/A
16	Drinking Water	N/A	N/A
17	Drinking Water	N/A	N/A
18	Drinking Water	N/A	N/A
19	Drinking Water	46° 43' 25.965"	124° 01' 09.657"
20	Drinking Water	N/A	N/A
21	Drinking Water	N/A	N/A
24	Drinking Water	N/A	N/A
25	Drinking Water	46° 43' 41.721"	124° 02' 02.562"
26	Drinking Water	46° 43' 42.380"	124° 01' 58.226"
28	Drinking Water	N/A	N/A
31	Drinking Water	46° 43' 41.867"	124° 02' 07.085"
32	Drinking Water	N/A	N/A
33	Drinking Water	N/A	N/A
34	Drinking Water	46° 47' 44.491"	124° 05' 25.451"

Station No.	Media	Latitude-North	Longitude-West
35	Drinking Water	46° 43' 16.137"	124° 00' 58.821"
35	Drinking Water	46° 43' 16.137"	124° 00' 58.821"
36	Drinking Water	46° 43' 16.521"	124° 00' 57.110"
37	Drinking Water	46° 43' 18.124"	124° 00' 58.636"
38	Drinking Water	46° 43' 35.535"	124° 00' 47.597"
39	Drinking Water	N/A	N/A
40	Drinking Water	46° 51' 53.713"	123° 56' 34.278"
41	Drinking Water	46° 53' 55.195"	124° 01' 55.660"
42	Drinking Water	46° 53' 19.851"	124° 01' 37.568"
44	Drinking Water	46° 40' 05.141"	123° 49' 07.520"
45	Drinking Water	46° 36' 03.008"	123° 56' 32.603"
46	Drinking Water	46° 43' 24.958"	124° 01' 01.645"
47	Drinking Water	46° 52' 55.620"	124° 06' 22.117"
48	Drinking Water	46° 43' 32.009"	124° 01' 23.562"
49	Drinking Water	46° 43' 03.351"	124° 00' 45.773"
50	Drinking Water	46° 42' 19.697"	123° 58' 10.568"
51	Drinking Water	46° 43' 34.025"	124° 00' 45.174"